JULY 1960

Heating Piping & Air Conditioning

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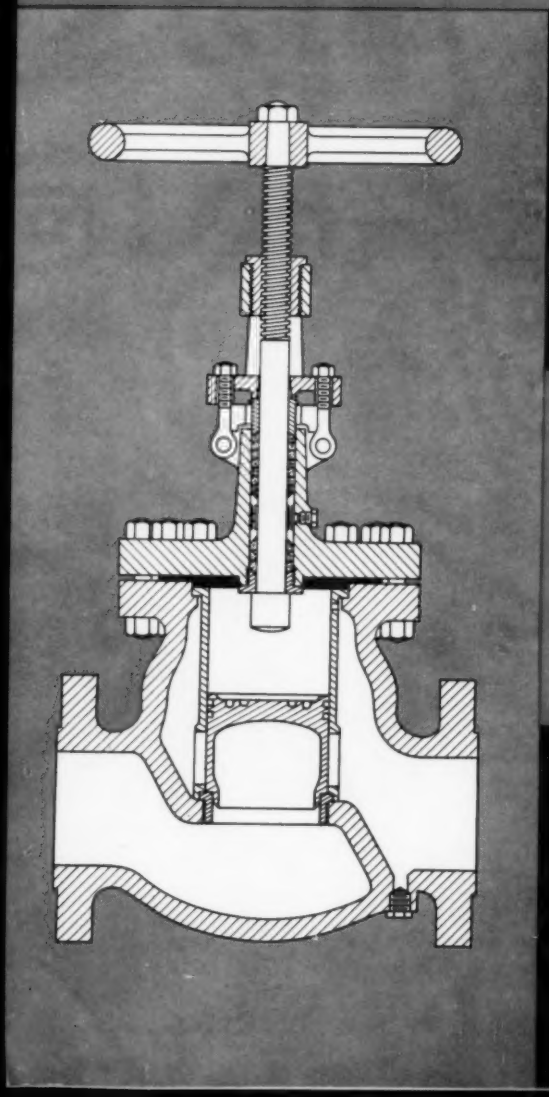
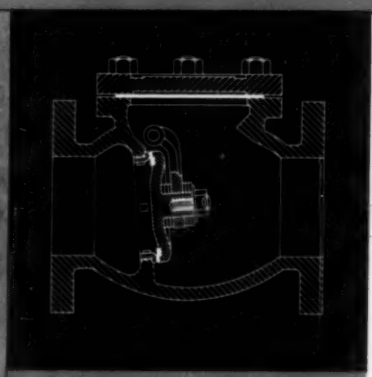
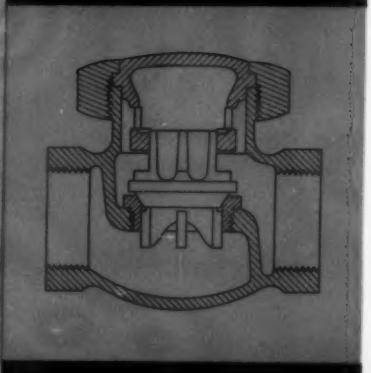
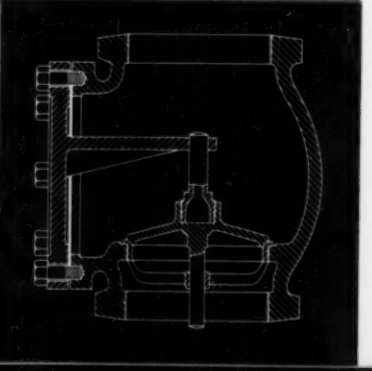
. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings









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Hot reheat pipe of new 325,000 KW unit No. 5 at Pacific Gas and Electric Company's Pittsburg Power Plant in California, showing line-up of 3 Grinnell Constant Support Hangers.

Grinnell Hangers support piping at Pittsburg Power Plant

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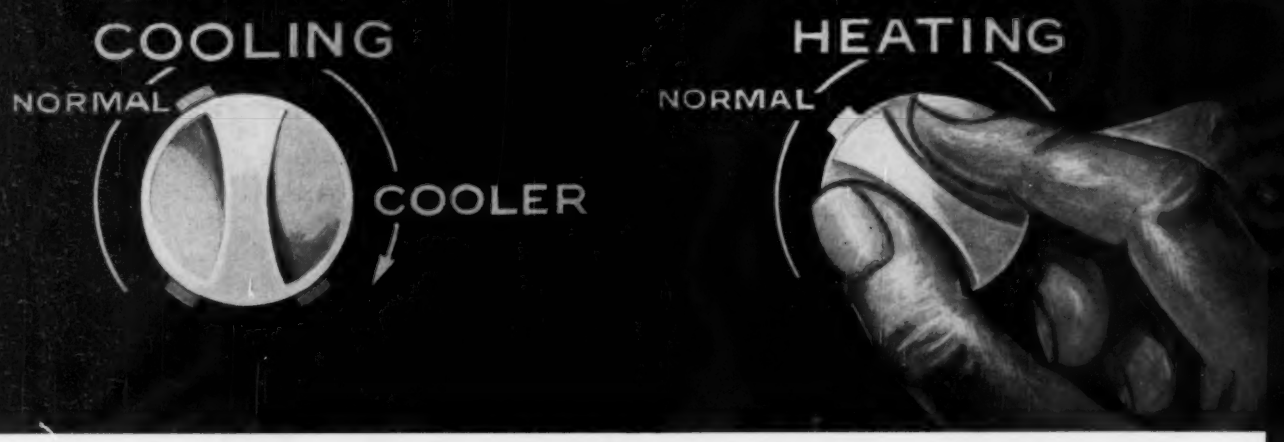

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FOR CONSULTING ENGINEERS, MECHANICAL (HEATING, PIPING, AND AIR CONDITIONING) CONTRACTORS, ENGINEERS WITH PLANTS AND BIG BUILDINGS

VOL. 32, NO. 7 JULY 1960

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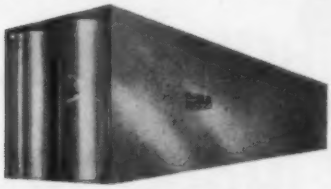

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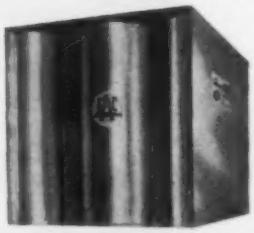

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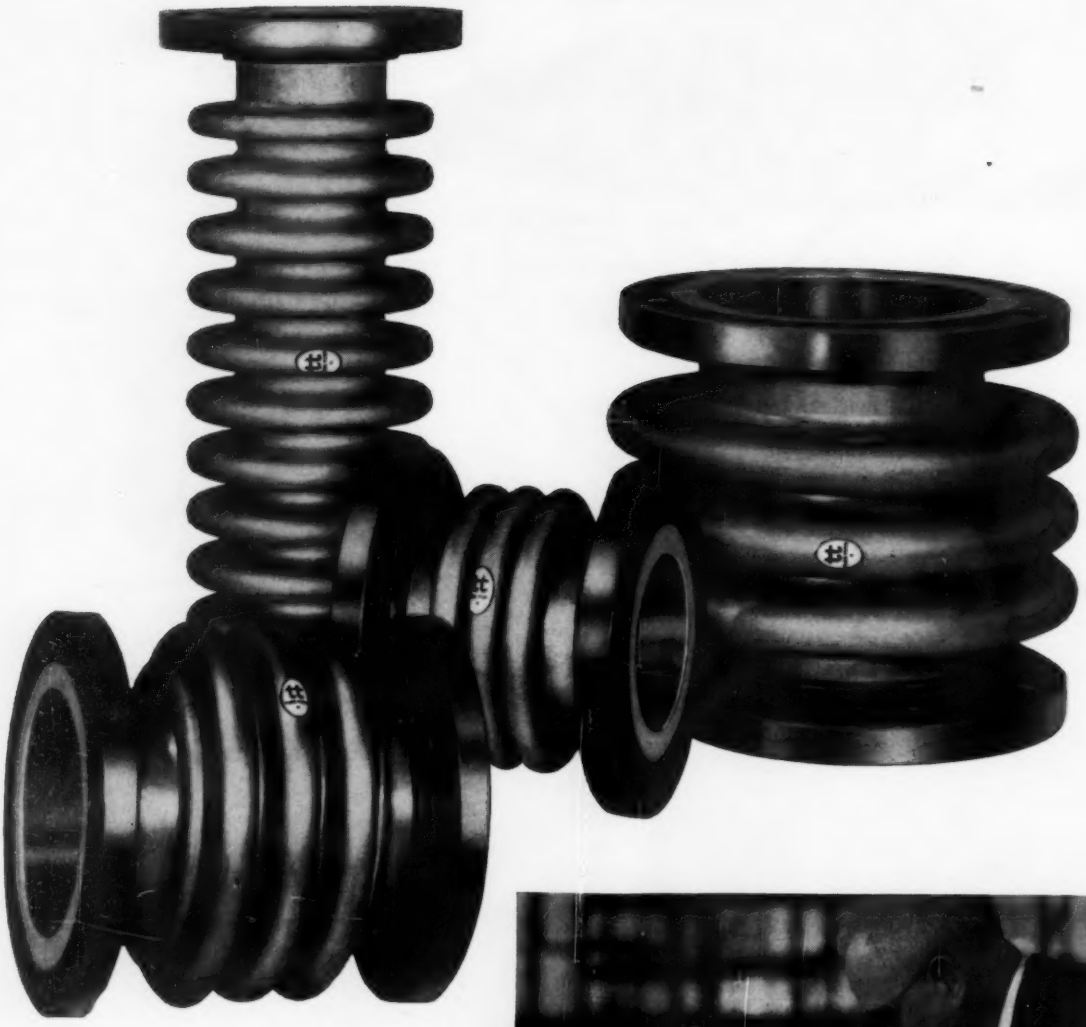

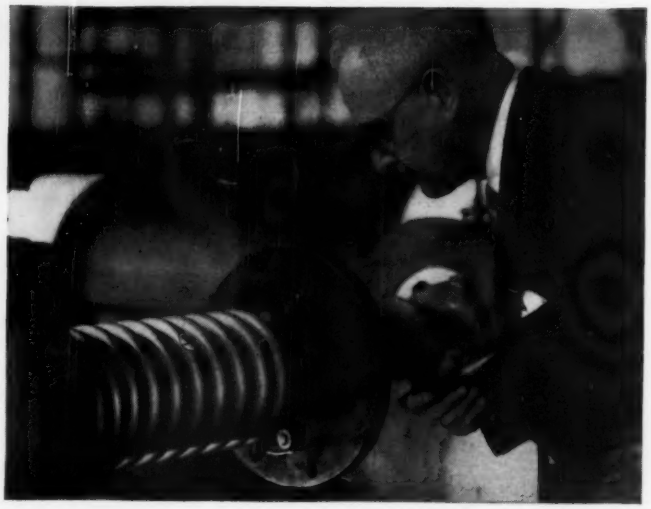

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LETTER FROM THE EDITOR

July 1960

Dear Reader:

Using a vacuum steam heating system together with outdoor reset control has proved to be quite successful for Anton Krapek in his engineering design of school heating systems. He explains in his article on pages 97 to 99 how this combination works. Outdoor temperature is constantly measured by an outdoor bulb, which in turn resets the control point of a vacuum regulator to provide the uniform flow of controlled steam to all heating units, regardless of their location. Mr. Krapek reports a series of tests that were conducted on this system in the Gier Park school in Lansing, Michigan, and he shows how a 22 percent fuel saving was measured by using this vacuum steam heating system and outdoor reset control arrangement.

The parking problem in Newark, New Jersey will soon be minimized when the new $5.6 million underground garage is completed. In garages of this type, of course, ventilation is quite critical. A dual system of forced supply and exhaust ventilation has been designed to provide 1.15 cfm of air per sq ft of total floor area to maintain safe carbon monoxide concentrations. The article on pages 100 and 101 explains how the design of these systems was determined after correlating the many studies that have been made of carbon monoxide contamination levels in similar facilities.

I am sure you will find the article on pages 102 to 104 to be of interest as it explains the importance of markings on welding fittings and flanges. New requirements on marking imported products are also noted.

In a recent survey conducted by the American Institute of Plant Engineers, improper ventilation proved to be the highest complaint in recently constructed buildings. John E. Lockhart and C. F. Mowery report these findings on pages 105 to 107, and they show where improvement in industrial ventilation systems should be made. It is apparent from this survey that more emphasis and effort must be devoted to convincing the owners and plant management that providing good industrial environment is essential. Of course this is why the series of 10 articles on this subject by John Clarke was published in Heating, Piping & Air Conditioning last year and is now available in book form. If you do not have your copy of this book, let me know and I will let you know how you can get a copy.

Heat pumps have a bright future, according to Robert Morse Wood, whose article is on pages 108 to 110. He cites several design factors which are worth noting as they can be used to indicate where heat pumps can be installed and operated satisfactorily.

Coal is a vital fuel, and Willie Hammer begins a series of articles this month on page 111 in which he answers many fundamental questions about its origin, availability, types, and how it is used. Mr. Hammer compiled a number of answers to similar questions on fuel oil which were published in our December 1958 issue that proved to be very popular. Likewise, this series on the subject of coal should be of value because it contains basic facts assembled in concentrated form.

LETTER FROM THE EDITOR (continued) --

The copper tubing corrosion studies conducted at Michigan State University show that water treatment has marked corrosive effects on copper tubing, as pointed out by M. F. Obrecht and L. L. Quill in their article on page 115. This is the fifth article in this series, and the results are worthy of study so these piping systems can be designed for long-time service.

The design of "spot cooling" for the diesel engine test facilities at the Cummins Engine Company plant in Columbus, Indiana was solved by H. W. Schiewe in an interesting way which he discusses on pages 126 to 129. Good worker comfort and top operating efficiency have been achieved with this system at low cost.

Designing and installing fuel oil piping systems for direct fired heater installations need to be done with a full understanding of several factors. M. H. Stern outlines the step-by-step procedures for designing these piping systems in his article on page 130. He also presents a sample problem to illustrate the design and installation of a typical system for a multiple heater system.

The air conditioning system for the new Dallas Home Furnishings Mart consists of 221 packaged horizontal units. William H. Balka, consulting engineer on the job, explains why these units were selected and how the system operates in his article on page 134. Because peak loads occur only during shows and when the Mart is open to buyers, the engineering analysis pointed to the use of these ceiling mounted units.

Valve accessories are most important in the conservation of manpower, assuring safety, providing convenience, and increasing the speed of operation. However, to select the proper accessories when designing piping systems, a thorough knowledge of those available and what they will do is important. This is one of the subjects discussed in the "HPAC Engineering Data File" by Carl A. Dopp on pages 141 to 152. In many cases these accessories are necessary if the valve is to properly serve its design function. Also discussed in this feature is what should be considered in selecting check valves to insure proper operation. Mr. Dopp gives many pointers based upon his 40 years of valve application experience on check valves and valve accessories which is worth keeping for ready reference.

Don't miss the "You'll Want to Know" news items beginning on page 39 and the many reader comments in "Open for Discussion" on pages 81 through 86. I would like to have your comments too about the information presented in this issue. Perhaps your experiences reflect different points of view which would be of interest to others.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

Meet Mr. Gabe Marin of Jamaica, New York—

Winner of Honeywell's big WIN-A-WAGON Contest!

Mr. Marin came closest to estimating the exact number of cycles completed by the new Honeywell R478 Programming Relay under rugged torture-testing. The correct number was 243,810—equivalent to over 16 years of normal operation!

Mr. Marin and his family are looking forward to many hours of motoring pleasure in the "Merry Olds"—America's most unique innovation in motor car travel in half a century!

Mr. Marin of the Sun-Ray Burner Manufacturing Company, says: "I've had a great deal of experience with Honeywell Flame Safeguards and I'm convinced they're *built to last!* So, I took this into consideration when making my 'guesstimate'—and I'm mighty glad I did!"

We're also pleased that Mr. Marin won the unique 1901 Olds —and we're happy to announce that the following men won deluxe Heiland Pentax 35 mm. Cameras for submitting the ten next-closest estimates:

Mr. Neale F. Laurence
Van Zelm, Heywood and Shadford
West Hartford, Conn.

Mr. George H. Dunbar
A. R. Newcombe Co., Inc.
Kingston, N. Y.

Mr. S. Nassau
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Our sincerest thanks to all those who entered the WIN-A-WAGON Contest! Remember, you may not have won a prize, but you'll always be a winner when you use the new R478 Programming Relay—it's built to last . . . and last . . . and last!

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- **50% fewer tubes** used than in former models—now encased in protective tube shields.
- **Simplified electronic timing**—one tube provides pre-purge, post-purge and trial for main flame ignition timings.
- **New armored back**—plus zinc-plated dichromate finish for increased resistance to corrosive industrial atmospheres.
- Fits same mounting as former model of the R478 for fast, easy replacement.

New! Unmatched flexibility in a flame safeguard! Never before has a flame safeguard offered so many applications and performance advantages as the new Honeywell R478 Protectorelay*: electronic flame detection, unparalleled sequencing flexibility, convenient voltage flexibility, simplified electronic timing and many other features.

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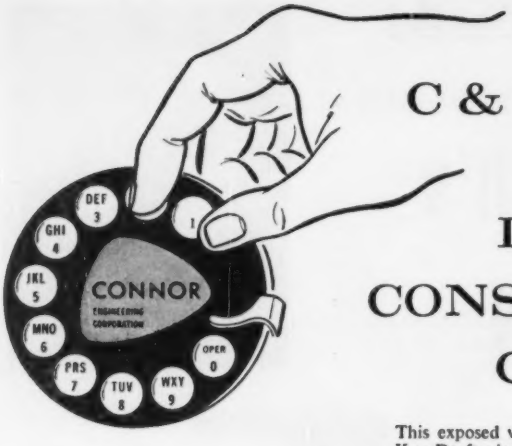

C & P Telephone Company of West Virginia Dialed "C" for CONSTANT COMFORT CONDITIONS

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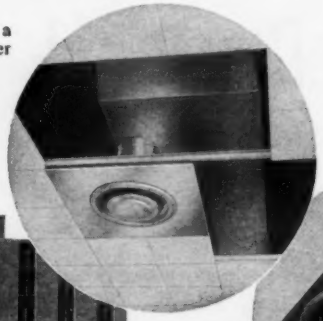
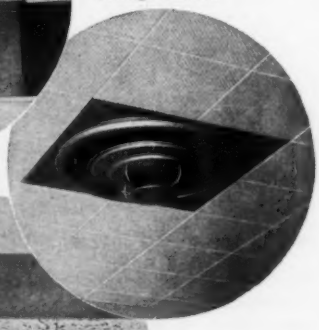
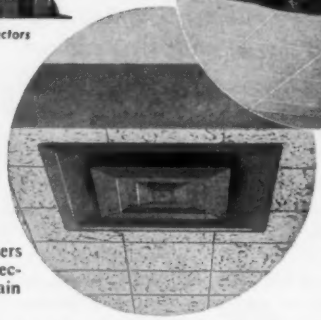


The combination air diffuser-loudspeaker offers functional and design advantages... both the sound source and the diffuser occupy the same strategic ceiling location.



Greife & Daley, *Architects* • McNeil & Baldwin, *Engineers* • Riggs Distler Company, *Contractors*

...in their handsome new office building, Charleston, West Virginia



Type KP (overlap) diffusers complement essentially recti-linear pattern of certain areas.

Commonly these days, business and industry call on leaders like Connor to provide new or remodeled buildings with modern interior atmospheric comfort that matches the modernity of architectural design.

Here in this new 4-story office building, for example, more than 800 various Connor units have been entrusted with the 'round-the-calendar job of giving the Telephone Company's employees a comfortable climate in which to work. In addition to producing effective air distribution, the Kno-Draft squares and rounds—with their clean, simple lines—blend neatly with the building's interior . . . and 230 Kno-Draft loudspeaker diffusers enable installation of both communication and comfort sources in the same strategic ceiling locations . . . just one installation hole for two separate, vital functions.

Seeking proper design and perfect function, architect, engineer, and contractor can choose confidently from the Kno-Draft line . . . can be sure that his choice will have the others' approval and will delight the client. Write for complete information.

CONNOR... for Constant Comfort Conditions

CONNOR ENGINEERING CORPORATION

DANBURY • CONNECTICUT

CONNOR ENGINEERING CORPORATION

kno·draft®

air diffusers

update your specs

ON

G-B GLASS FIBER INSULATIONS

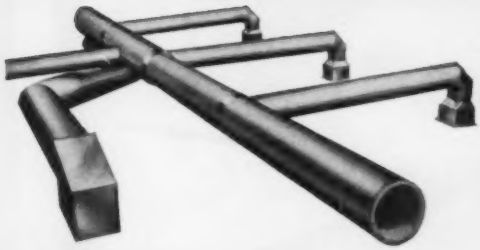
Technical bulletins on the Gustin-Bacon glass fiber insulations shown here, including complete specifications, have been revised and reprinted from time to time. To be sure your literature file is up-to-date, simply fill in the coupon below, check the information you need, and mail.

G-B SNAP*ON® pipe insulation

Second to none in insulating efficiency among all general purpose pipe insulations is G-B SNAP*ON — the original one-piece pipe insulation molded of fine glass fibers. In one simple motion G-B SNAP*ON snaps over cold or hot lines up to 350°, indoors or out, to provide truly efficient and permanent thermal protection. Check **G-B SNAP*ON Brochure** in coupon below.

G-B ULTRALITE®
for duct wrap and lining

For life-long thermal efficiency, try ULTRALITE —the original insulation made of long, **strong** textile-type glass fibers. As a duct liner (right), ULTRALITE puts an end to objectionable cross-talk and air rush noises . . . never flakes off into the air stream. And its coefficient of friction is essentially the same as bare sheet metal. Uniformly thick ULTRALITE duct insulation (left) provides full insulating efficiency at rock-bottom costs. For further information, check **ULTRALITE Duct Liner & Insulation Brochure** in coupon below.



new "prefab"
glass fiber duct — G-B DUCT

G-B DUCT — the round, prefabricated duct made entirely of glass fiber insulation — absorbs cross-talk noises usually associated with air conditioning systems in motels, medical centers, retail stores, etc. G-B DUCT is high in thermal efficiency, too! Just check **G-B DUCT Brochure** in coupon at right for further information.

CHECK BROCHURE DESIRED

- ☐ G-B SNAP*ON BROCHURE
- ☐ ULTRALITE DUCT LINER & INSULATION BROCHURE
- ☐ G-B DUCT BROCHURE

NAME.....

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ADDRESS.....

CITY.....STATE.....

GUSTIN-BACON Mfg. Co. gb

220 West 10th St., Kansas City, Mo.

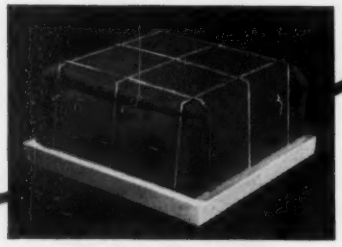
Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation . . . Couplings and fittings for plain and grooved end pipe.

THE STARTLING FACTS ON THE

New ULOK Cube BRAND

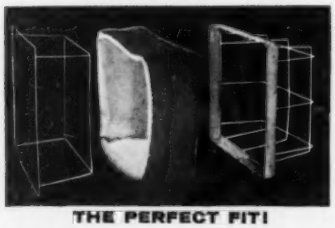
THE PERFECT FIBER!

UNION CARBIDE research has produced the truly ideal filter medium in DYNEL modacrylic fiber—a strong, high capacity fiber with an irregular, highly arresting cross section.



THE PERFECT FORM!

Basic component is a low density, three-dimensional batt, sewed into cube shape. Rust-proof retainer frame is inserted in batt, then batt is inserted in wire retaining basket. Final three-piece assembly is supported by holding frame within unit, is easy to handle—no sharp edges or "splinters". Easy to dispose of when full—simply collapse and discard . . . the dust is in the bag!



THE PERFECT FIT!

Shape of retainer frame inside batt permits filter to seal itself in holding frame. Final filter assembly is a tight, leak-proof, press fit.

Type Air Filter:

New Filter Medium!

DYNEL filter medium stops and holds unusually large quantities of dirt. Self-sealing, leak-proof assembly completely eliminates problem of filter bypass . . . provides maximum economy at highly acceptable filtration levels.

Saves Change-Over Dollars!

ULOK Cube Filter lasts 6 times longer. Dirt is first trapped on inside face of filter. As dirt builds up, air flow is shunted to large filtering area of four sides. Thus, even after several *pounds* of dirt have been collected, high filtering efficiency and low pressure drop is maintained. This "reverse loading" process increases service life *6 times* over that of conventional filters. Think of the savings in maintenance!

Uses Half The Space!

Medium-size ULOK Cube Filter has a filtering surface of 1040 sq. in.—140 more than a conventional 30″ x 30″ flat filter—yet it presents a frontal area of only 20″ x 20″. Filter bank area can thus be reduced by *half* with medium-depth filter, *even more* with deeper models.

At All Velocities!

ULOK Cube Type Air Filters afford the high filtering efficiency characteristic of low velocity units even in units employing air volumes as high as 1970 cfm!

Proved In Operation!

ULOK Cube Type Air Filters have been soundly proved in numerous installations. Reflecting a complete range of the filtering problems presented under varying operating conditions, these field trials were complemented by extensive and extremely severe laboratory tests.

Ideal for all commercial and industrial air conditioning, heating, and ventilating systems, ULOK Cube Type Air Filters are available in 12 sizes to meet any requirement.

WRITE TODAY FOR FURTHER INFORMATION AND PRICES.

UNION CARBIDE ULOK BRAND

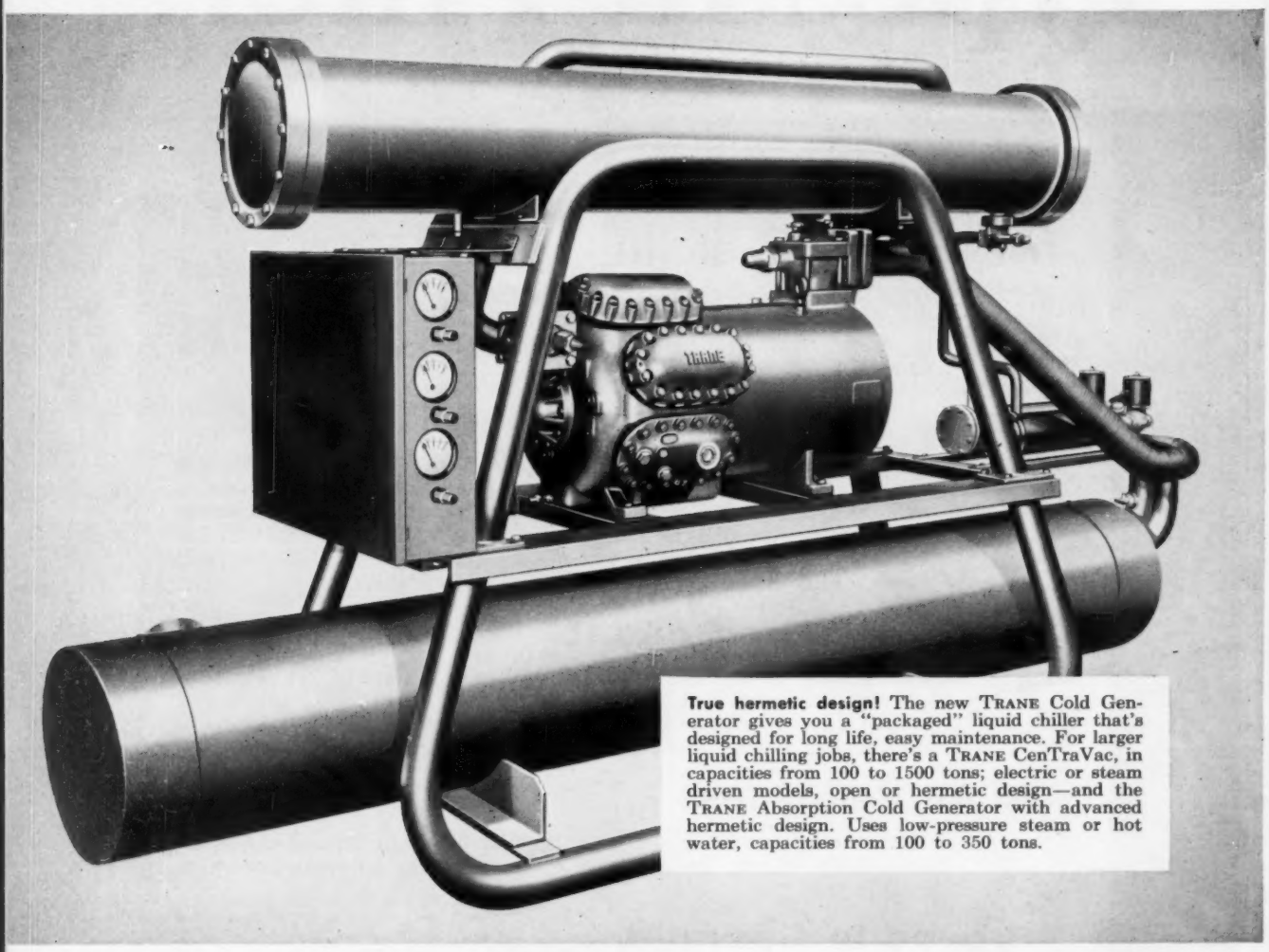
UNION CARBIDE DEVELOPMENT COMPANY

Division of Union Carbide Corporation

270 Park Avenue • New York 17, N.Y.

ULOK and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

For faster installation, make it a new Trane



True hermetic design! The new TRANE Cold Generator gives you a "packaged" liquid chiller that's designed for long life, easy maintenance. For larger liquid chilling jobs, there's a TRANE CenTraVac, in capacities from 100 to 1500 tons; electric or steam driven models, open or hermetic design—and the TRANE Absorption Cold Generator with advanced hermetic design. Uses low-pressure steam or hot water, capacities from 100 to 350 tons.

Now! A hermetic model of the Trane Reciprocating Compressor!

Here's a new, efficient Reciprocating Compressor that's *fully hermetic*, designed for the more rigorous demands of R-22. This unit is of single-housing construction. Motor and compressor are in one shell, with a bolted end cover for easy access. This minimizes alignment problems experienced with other hermetic compressors that have 2-part housing.

The new TRANE Hermetic Reciprocating Compressor has multi-step capacity control that saves power by reducing starting, stopping. And the truly hermetic design eliminates crankshaft seal and coupling to provide quiet operation, simplified installation, longer life.

Check these advanced TRANE features:

- **Designed for R-22 and R-12** (not a converted R-12 machine).
- **Single-housing construction** for simplified installation, trouble-free operation, easy access for maintenance.
- **Multi-step capacity control** reduces starting, stopping, saves power.
- **Exclusive internal thermal protector,** located in the motor windings, protects against any condition that causes high motor temperatures.
- **Large suction chamber** and cylinder head safety springs provide protection against refrigerant slugging.
- **Available** in sizes from 10 to 100 tons.

trouble-free operation, Hermetic Cold Generator

Here's a "packaged" liquid chiller of advanced design for a wide variety of process or comfort applications

When you plan your next refrigeration job—for comfort or process cooling—look at this new TRANE Reciprocating Cold Generator. It's *hermetic*, to provide you with a vastly improved machine for a wide variety of applications. It features an all-new TRANE Hermetic Compressor (illustrated and described below); a new chiller; a new condenser with a built-in sub-cooler that eliminates the need for a heat exchanger in built-up systems. All of these major components are arranged to provide an amazingly compact and efficient machine; and all three are engineered and built by TRANE. They are designed and built together to work together.

The new TRANE Reciprocating Cold Generators are designed for either R-22 or R-12—except the 10-ton model that uses R-12 only. Exceptionally compact and lightweight, the units will pass easily through a standard 36″-wide door. Available with pneumatic or electric controls, they are preassembled, prewired. There is no on-the-job wiring except for lead-in. The advanced design assures maximum efficiency on a tons-per-hp basis. They operate quietly, efficiently . . . are easy to maintain.

Want more facts? For complete information and specifications on the new TRANE Hermetic Cold Generator—and the complete line of TRANE Water Chillers from 10 to 1500 tons, contact your nearby TRANE Sales Office; or write TRANE, La Crosse, Wisconsin.

Check these advanced TRANE features:

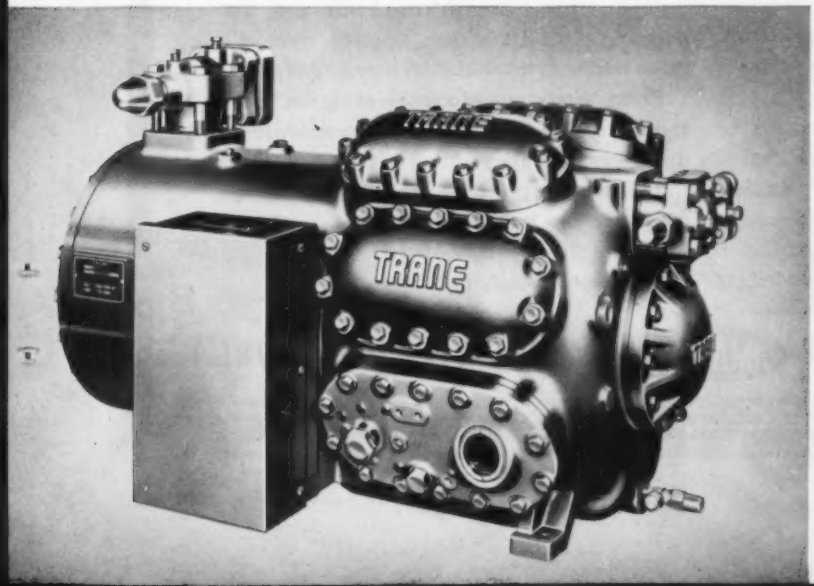
- **All major components,** chiller, condenser, compressor, designed and built by TRANE.
- **Advanced hermetic design** assures maximum efficiency, simplified maintenance and installation.
- **Compact size;** small enough to pass through a standard 36″-wide commercial door.
- **Packaged design;** factory-wired and assembled to cut on-the-job labor. Pneumatic or electric control panel mounted and prewired.
- **Versatile.** May be used for any process or comfort liquid cooling application . . . to maintain constant temperature for electro-plating baths and other critical operations. Units available for use with evaporative or air-cooled condensers.

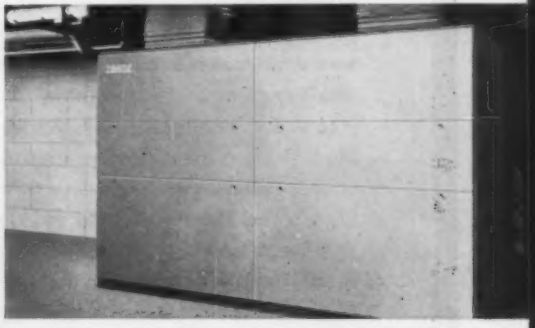
For any air condition, turn to

TRANE

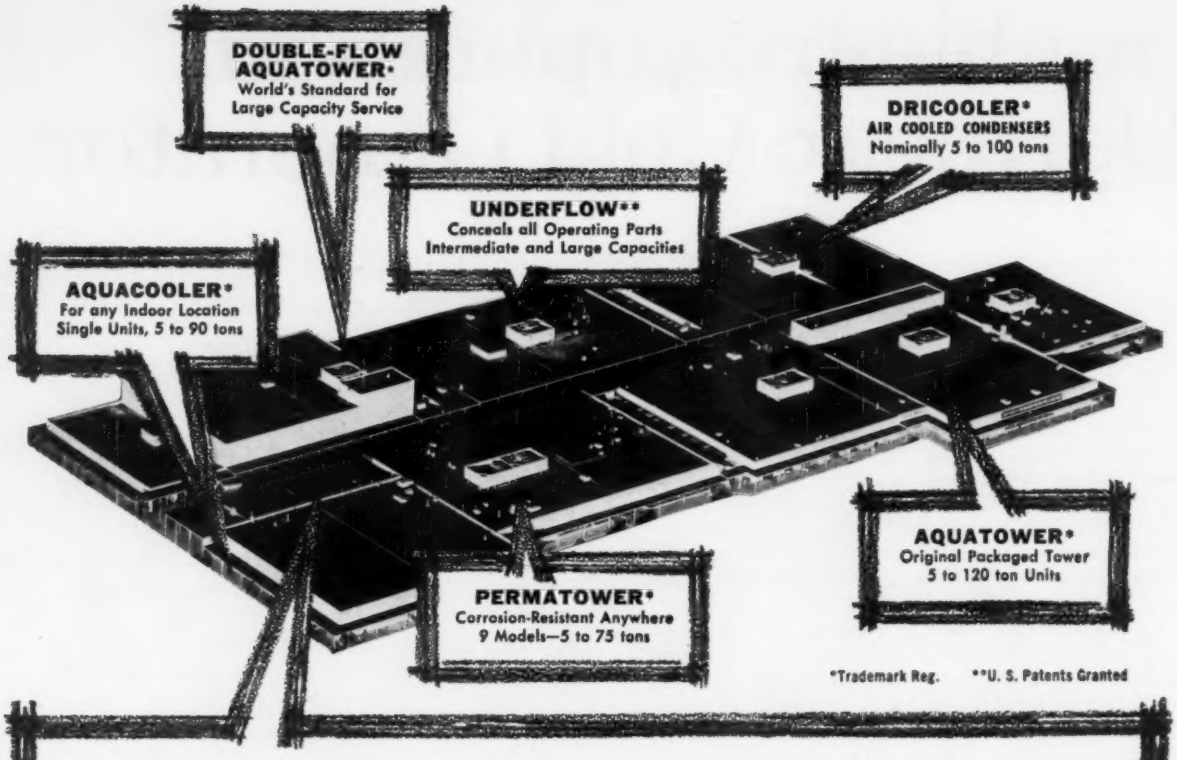
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA.
CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO
100 U.S. AND 19 CANADIAN OFFICES





Trane Commercial Self-Contained Air Conditioners feature the new TRANE Hermetic Compressor. Quiet and compact, these units provide maximum cooling comfort for commercial and industrial applications. Feature new TRANE Sigma-Flo Fin Coils for greater efficiency in less space. Air or water-cooled models in sizes from 10 to 50 tons.



*Trademark Reg. **U. S. Patents Granted

Call MARLEY — and you're in touch with the world's largest "Shopping Center" for COOLING TOWERS

Many engineers and contractors look no further than the Marley Company in selecting cooling towers and air cooled refrigerant condensers. For Marley offers "one-stop shopping" — the world's most complete line, in which there's a tower pinpointed for every individual requirement. Performance-conscious professionals also recognize the superior performance of products that bear the Marley name and are backed by the company's single-responsibility guarantee.

In every cooling category, Marley makes the leading equipment. Where packaged cooling towers of modest capacity are indicated, there's the Marley Aquatower, performance-proved in tens of thousands of outdoor installations, and a Marley AquaCooler for indoor service. If corrosion is a special problem, Marley offers the popular Permatower line that makes liberal use of inert materials. If air is the logical cooling medium, Marley's newly-designed DriCoolers offer improvements not available elsewhere. And in the field of intermediate-capacity cooling, Marley's Double-Flow Aquatower and the patented Underflow are selected over all other makes in a substantial majority of cases.

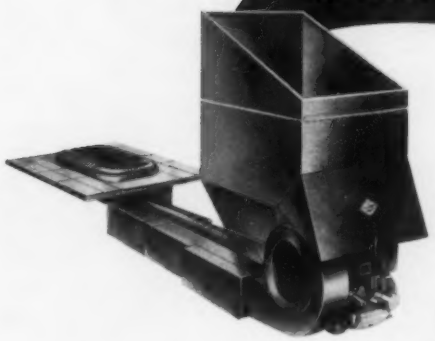
From every standpoint — selection, performance, flexibility, economy, maintenance, durability — Marley products are ideally suited to all types of operations. For information on the complete line, call your nearby Marley Application Engineer, or write today for descriptive bulletins.

THE MARLEY COMPANY MARLEY KANSAS CITY, MISSOURI

WILL-BURT STOKERS

for institutional, commercial, and industrial buildings

CAPACITIES 65 through 750 lbs. per hour



HOPPER MODELS — BIN FEED MODELS — Refractory or Deadplate Types

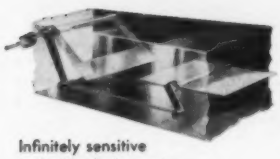
Complete drawings, dimensions, suggested specifications, and typical installation drawings are provided in Will-Burt Reference Manual 30-G-3. The manual, including stoker layout tracing templates, sent on request. Suggested installation drawings and wiring diagrams are supplied on request by our engineering department.

CONDENSED DATA — WILL-BURT HOPPER AND BIN FEED MODEL STOKERS

STOKER NUMBER			65	75	100	125	151	150	200	250	300	350	400	500	600	750
Coal Burning Rate (Approximate Lbs. Per Hr., Continuous Operation)			26 45 65	30 50 75	40 70 100	50 88 125	60 105 150	60 105 150	80 140 200	100 175 250	120 210 300	140 245 350	160 280 400	200 350 500	240 420 600	300 525 750
Steam Radiation			2110	2435	3250	4375	5250	5250	7000	8750	10500	12250	14000	17500	21000	26250
Water Radiation			3380	3900	5200	7000	8400	8400	11200	14000	16800	19600	22400	28000	33600	42000
Gross Output 1000's B.T.U. Per Hr.			507	585	780	1050	1260	1260	1680	2100	2520	2940	3360	4200	5040	6300
Boiler H.P.			15.1	17.5	23.3	31.4	37.6	37.6	50.2	62.7	75.3	87.8	100	125	150	188
Combustion Volume Min. Cu. Ft.			13	15	20	25	30	30	40	50	60	70	80	100	120	150
Setting Height Min. In.		Steel Boiler	23	24	27	28	28½	28½	30	31½	33	34½	36	39	42	46½
		Cast Iron Boiler	20	21	23½	24	25	25	26½	27½	29	30	31½	34	37	40½
Motor H.P. Hopper Model			½	½	½	½	¾	¾	¾	1	1	1½	2	2	3	5
Motor H.P. Bin Feed Model		Power Unit	¼	¼	¼	¼	½	½	½	½	½	½	½	¾	¾	1
		Fan	½	½	½	½	½	¾	¾	¾	¾	1	1½	1½	2	3
Hopper Capacity			600	600	600	600	1000	1000	1000	1000	1000	1000	1000	1000	1000	1200
Fan Capacity C.F.M.			660	660	1320	1320	1320	1405	1405	1875	1875	2720	2720	2720	2720	4080
Coal Screw Diameter			3⅛	3⅛	3⅛	3⅛	3⅛	4⅛	4⅛	4⅛	4⅛	4⅛	4⅛	4⅛	4⅛	4⅛
Coal Screw Removal	Std. Hopper Model, Min. Clearance Req'd., Inches		25	26	28	30	15	15	15	15	18	20	20	23	26	44
Weight Crated Lbs.	Standard Hopper Model	Refractory	760	810	850	900	1020	1470	1470	1500	1680	1750	1750	1810	1840	2005
		Dead Plate	—	—	—	1040	1160	1760	1760	1805	2000	2210	2210	2380	2440	2670
	Standard Bin Feed Model	Refractory	800	850	900	950	980	1590	1590	1650	1830	1900	1900	1960	2010	2070
		Dead Plate	—	—	—	1090	1120	1880	1880	1955	2150	2360	2360	2530	2610	2735

Load values given are based on over-all boiler and stoker efficiencies of 65%, to and including 100 lbs. per hr., and 70% for those stokers over 100 lbs. per hr. capacity, using coal with heat value of 12,000 B.T.U. per lb.

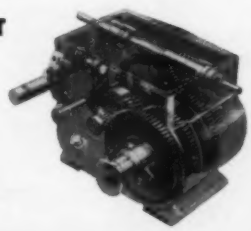
AUTOMATIC AIR CONTROL

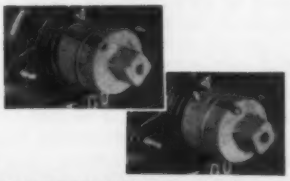


Infinitely sensitive to fuel bed air requirements—eliminates need for manual air adjustments.

3-FEED POWER UNIT

Continuous, satisfactory service of Will-Burt Transmissions of this same design for over twenty years is proof of their dependability.

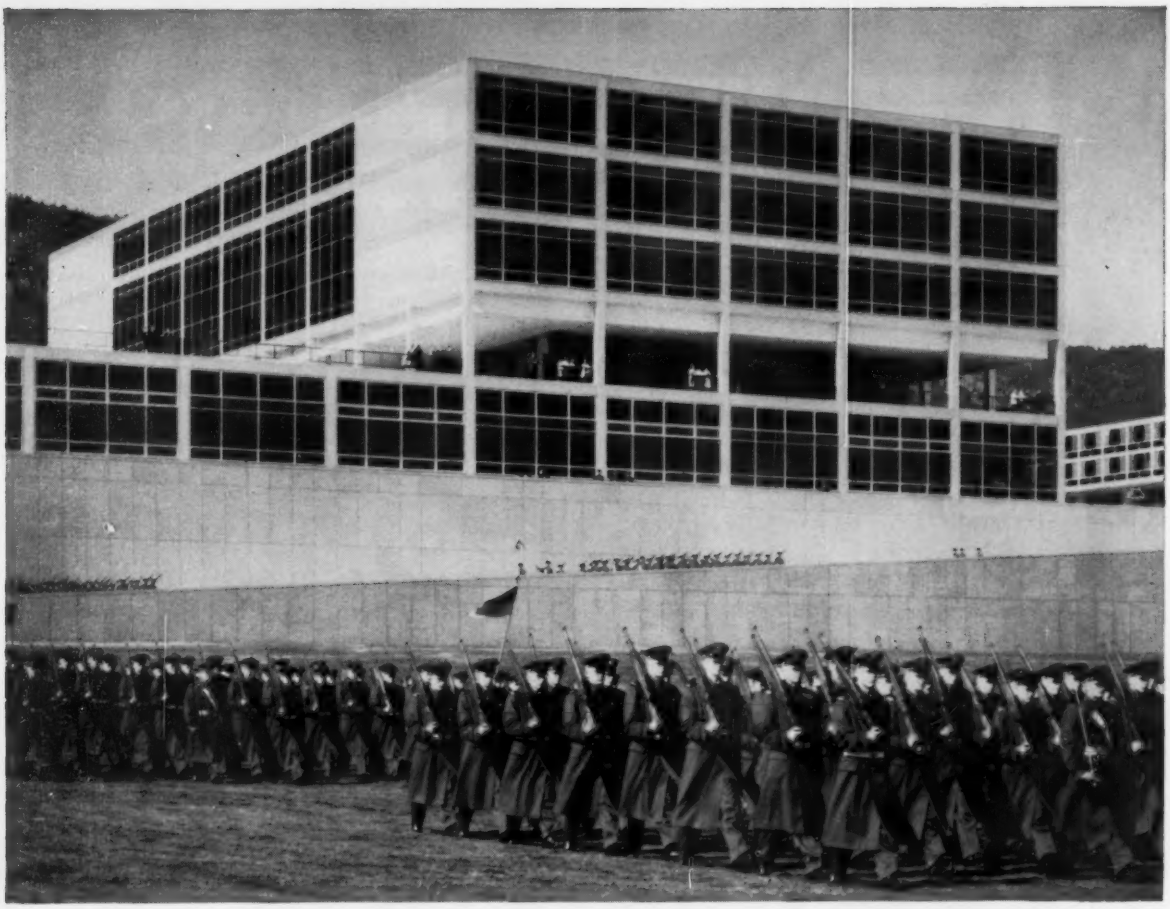




SAFETY SHEAR PIN DISCONNECT

Protects against overload — pin easily replaced, service quickly restored.

THE WILL-BURT COMPANY • ORRVILLE, OHIO, U.S.A. • *Over 28 years in the stoker business*

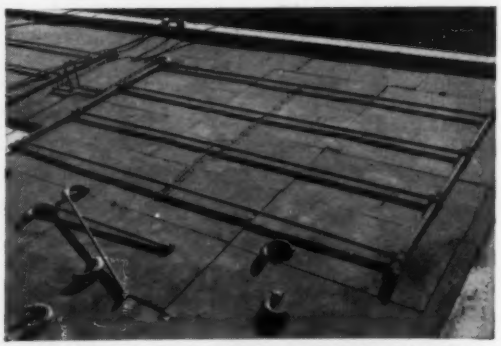


At the end of the day, **steel pipe** brings the comforts of home to the airmen of tomorrow

Saturday's parade ends a schedule-filled week for 1,500 cadets at the U. S. Air Force Academy near Colorado Springs. From the parade grounds the cadets return to their quarters . . . the world's most modern in comfort and convenience for housing the nation's air-leaders of tomorrow.

Steel pipe contributes much to making the Academy the world's finest. For radiant heating over five miles of *steel pipe* were used. In the 17,800 acre Academy Complex, the plumbing, vent and drainage lines were fabricated from *steel pipe*. And, it was used because—in an evaluation of service life, ease of fabrication, availability and cost—*steel pipe* proved superior to any other tubular product.

At the U. S. Air Force Academy, as in buildings throughout the nation, *steel pipe* is the perfect, low cost tubular conductor of water, gas and oil. The high thermal conductivity and structural strength of *steel pipe* make it ideal for many applications including radiant heating, cooling, refrigeration, ice making, snow melting, electrical conduit and myriads of residential, commercial and industrial applications.



Prefabricated steel pipe sections resulted in quick and easy installation for the radiant heating system at the Academy. Because the coefficient of expansion of steel pipe and the concrete slab in which it's embedded are compatible—long service life is assured.

STEEL PIPE IS FIRST CHOICE

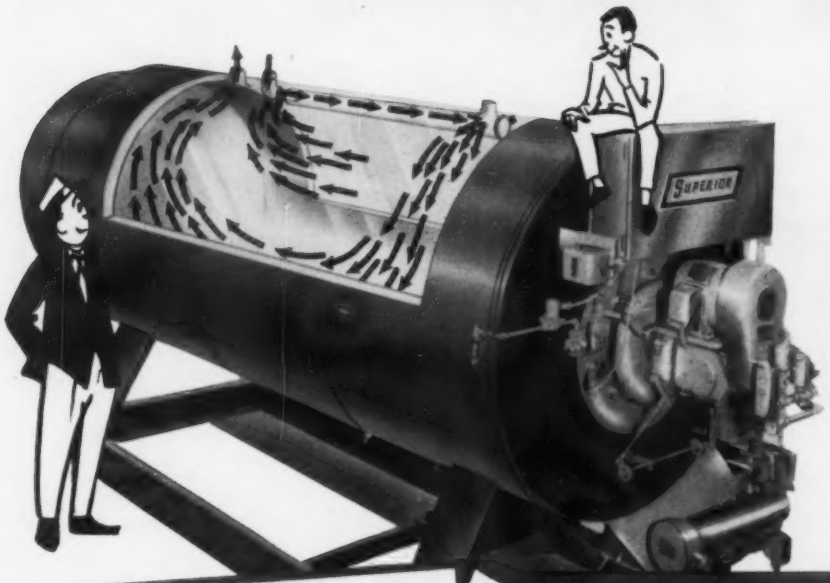
- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

INSIST ON PIPE MADE IN U.S.A.

COMMITTEE ON STEEL PIPE RESEARCH

150 East Forty-Second Street, New York 17, N.Y.

look what's happened to hot water boilers!



No, we're not making them with windows . . . we did that in the illustration to show you our NEW Venturi-action Mixing Tube which is the talk of the industry.

Venturi-Action Mixing Tube plays a triple role:

1 It starts by mixing entrained water from the boiler with water entering the boiler.

2 Traveling through the tube, the temperature is further modified by the surrounding water.

3 Jet action at the end of the tube directs flow downward and outward against the outer confines of the shell, providing a circulation pattern unequalled in any other hot water boiler.

SUPERIOR "TYPE CC"

For details of Superior's Hot Water Boilers in sizes to 350 BHP write for catalog CCW-14.
For sizes from 400 to 600 BHP write for catalog CFW-14.

Simple as it is, the importance of this NEW Venturi-action Mixing Tube can hardly be over-emphasized; for hot water boilers in many types of installations are subjected to rapid and extreme changes of water temperature. When the distribution of cool water is not completely equalized, the resulting expansion and contraction of the boiler causes stresses and strains which have become known as Thermal Shock.

No hot water boiler can be made to withstand severe and repeated Thermal Shock . . . but this new Superior Boiler is designed to reduce it to a minimum.

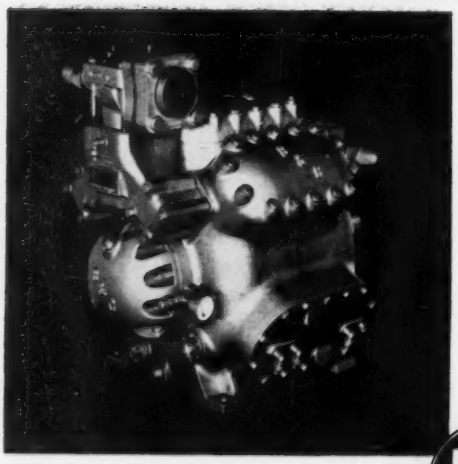
Available in sizes to 600 BHP, Superior's Hot Water Boiler is the answer to trouble-free hot water heating.

Specialists in PACKAGED BOILERS . . . exclusively

SUPERIOR COMBUSTION INDUSTRIES, INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
PACKAGED BOILERS

CHECKING OUT TWO 150 TON B&G® PACKAGE LIQUID COOLERS



All B&G Package Liquid Coolers and Condensing Units from 7½ to 150 tons are equipped with this new-design B&G Compressor.

Here is the final and a very important stage in the production of B&G Package Liquid Coolers. When the four men finish this check-out, the units will be shipped with *everything mechanically correct and in accordance with the requirements of the order.*

These two 150 ton Package Liquid Coolers have completely wired panels with increment starting—*virtually plug-in units!* All major parts are made in the B&G plant...resulting in a unit unmatched for efficient operation and carrying one manufacturer's guarantee!

One of their outstanding features is the compressor, a masterpiece of advanced designing and precision manufacture. It establishes an entirely new standard of performance—smoother, quieter and with minimum vibration. All compressors have *one* bore—a few interchangeable parts will service all units, reducing maintenance problems.

BELL & GOSSETT
COMPANY

Dept. RGG-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

A FULL LINE OF REFRIGERATION AND AIR CONDITIONING "PACKAGES" AND COMPONENTS

B&G Condensing Unit

B&G Evaporator

B&G Centrifugal Pump

B&G Condenser

Now, all Spang CW Galvanized Steel Pipe carries this new marking which is your assurance of top-quality domestic steel pipe.

Look for this marking when you buy steel pipe

It spells two important advantages for you:

1. Pipe made in the United States of America must meet the high product standards set by definite technical specifications established for all pipe manufacturers. When you buy American-made steel pipe, you know you're getting a fine, standard product with good working characteristics and assured long life that will meet specified service requirements.

2. The Spang CW Steel Pipe marking indicates that extra measure of quality. When you buy Spang, you know you're getting a product that's carefully controlled during manufacturing and thoroughly tested and inspected before shipping to assure you of a top-quality product, uniform throughout, for fast, economical, trouble-free installations.

Don't take chances by making second-rate installations with questionable foreign imports. It's worth your reputation to buy Steel Pipe made in USA. It pays in the long run!

Look for this Spang marking on your next pipe order. You can't buy a better pipe! Your local Spang Distributor can give you top-quality service. Give him a call!

Steel's Symbol of strength, long life, and economy

New "Made in USA" marking on Spang CW Galvanized Steel Pipe is applied after pipe has been quick-quenched following galvanizing.

SPANG CW STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation

Right, PPG insulation is easily cut to size on the job. Left, Foreman Charles W. Booth, of Acheson Sheet Metal Company, supervises installation of ductwork. PPG Neoprene-coated Duct Liner meets all requirements of NBFU Bulletins No. 90-A and 90-B for ducts, and bears the label of Underwriters' Laboratories, Inc.

The inside story on a hush-up job in Tampa

(with PPG Fiber Glass Insulation, of course!)

It will be quiet, as well as comfortable around the new State Agency Building at Tampa, Florida, because PPG Fiber Glass Insulation has been installed in the ductwork of the heating and air conditioning system.

Job foreman Charles W. Booth of Acheson Sheet Metal Company, Jacksonville, installers of the ductwork, reports that the long life-expectancy of PPG Neoprene-coated Fiber Glass is of great importance in the choice of this insulation, because of the difficulty of replacement in a duct system.

It's what's inside that counts!

Mr. Booth says that PPG Insulation has extraordinary sound-deadening qualities which eliminate fan noise, has excellent thermal-barrier characteristics, and low resistance to air flow. In addition to ease of handling and installation, it will not be affected by humidity, won't swell, rot or decay . . . very important in Tampa-types of climates!

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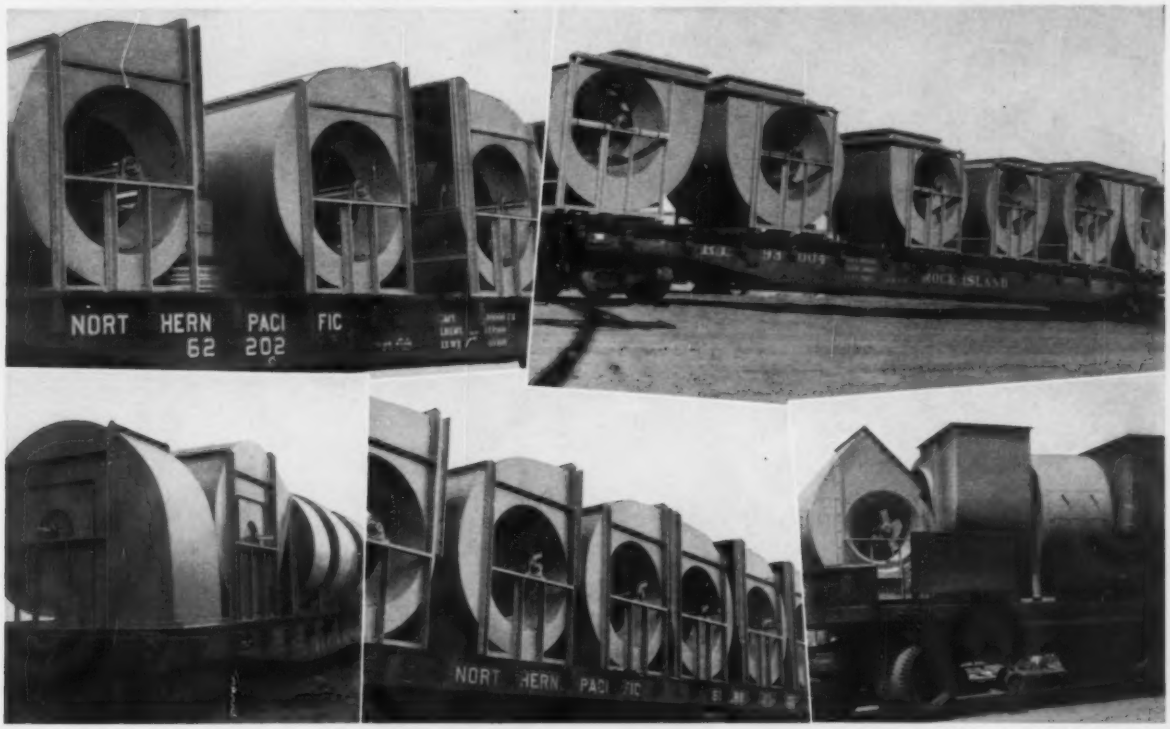

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Stop pipe condensation with the built-in vapor barrier of J-M Aerotube

...THE FLEXIBLE, FOAMED PLASTIC PIPE INSULATION THAT CUTS INSTALLATION COSTS IN HALF.

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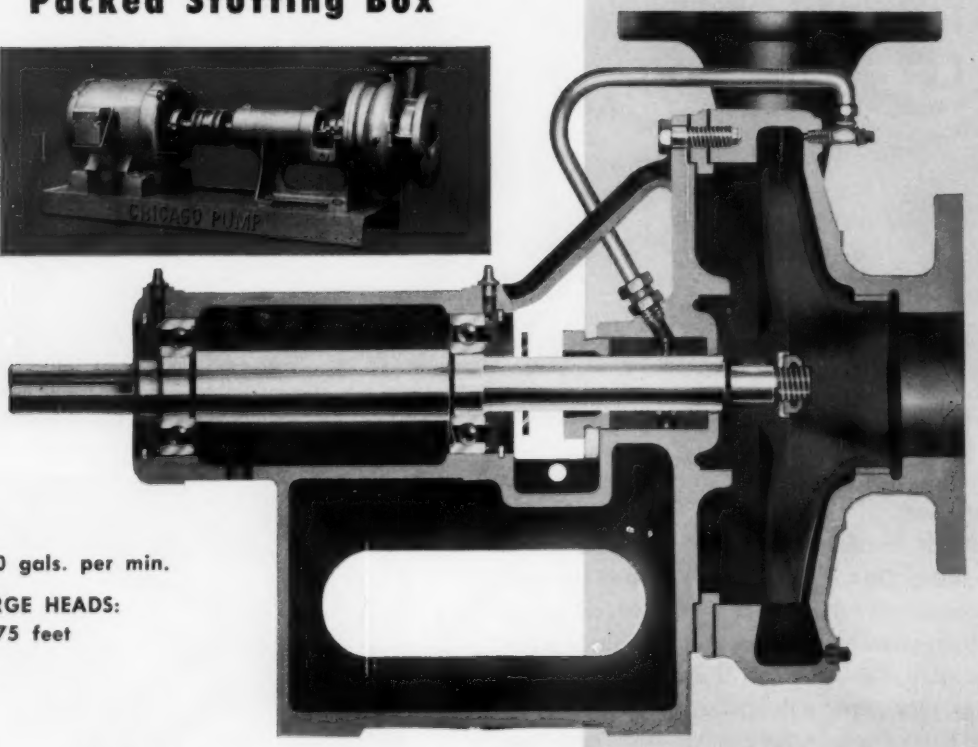

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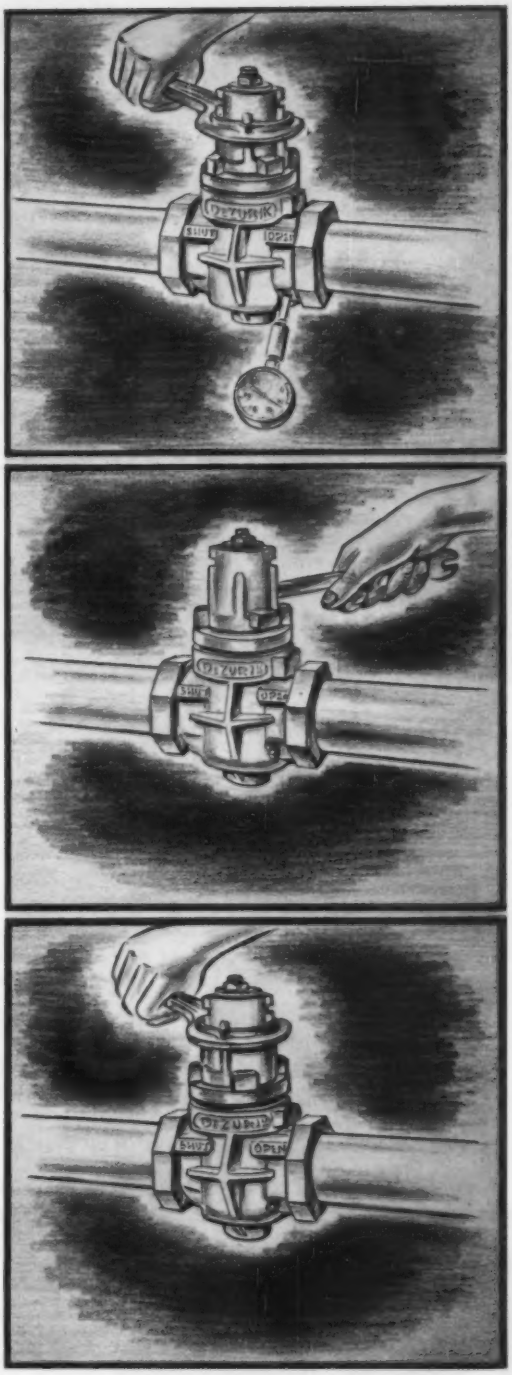

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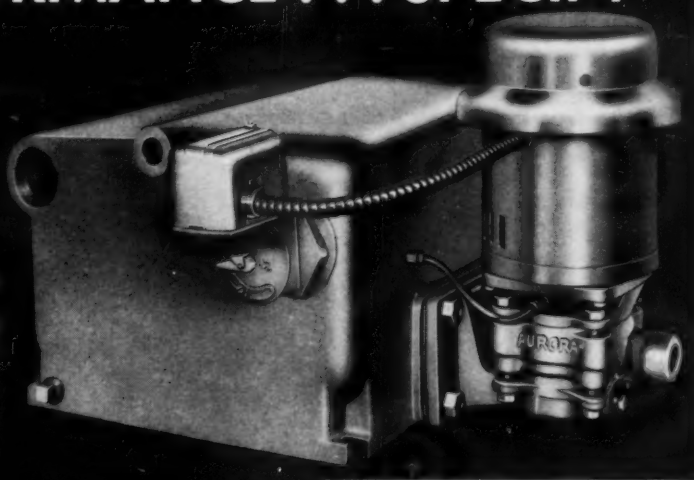

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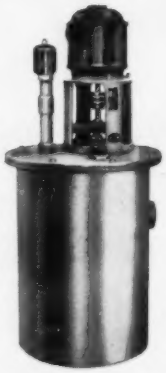

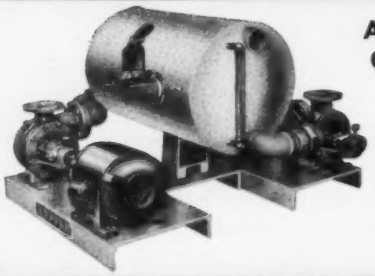

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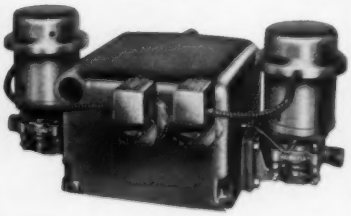
With automatic range adjustment, equalized pressure, and the many advantageous features of APCO Turbine Type Pumps

TYPE C HEAVY DUTY UNITS Capacities to 150,000 EDR 225 GPM



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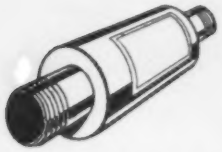
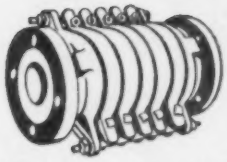
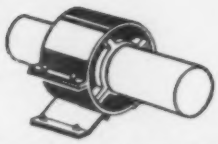


FLEXONICS Model H Expansion Compensator —in sizes to 3", for pressures to 175 p.s.i., absorb 2" total pipe motion at each unit.



FLEXONICS Expansion Joints — controlled-flexing, free-flexing, and many special types, in an unlimited range of sizes.



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ENGINEERS ACROSS THE COUNTRY ARE SPECIFYING FLEXONICS MODEL L PACKLESS EXPANSION COMPENSATORS

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ALLEN-BRADLEY
Solenoid Starters give

MORE MILLIONS OF TROUBLE FREE OPERATIONS

. . . and for good reasons

• ONE MOVING PART
With this simple solenoid design, there's virtually nothing to go wrong—all trouble-causing bearings, pivots, and flexible jumpers have been eliminated.

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Allen-Bradley silver alloy contacts never require maintenance. They are always in perfect operating condition . . . and remain so until completely worn away.

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The virtually frictionless, straight line vertical motion provides uniform contact pressure at all times—and assures consistent, rapid operation of the contactor.

• RELIABLE OVERLOAD PROTECTION
All A-B starters are equipped with two permanently accurate and reliable overload relays that protect motors against "burnouts." Three overload relays can be furnished.

BULLETIN 709 STARTERS are made in 9 sizes from Size 0 (at left) up to Size 8.

BULLETIN 709 SIZE 7 with maximum ratings of 300 hp, 220 v; 600 hp, 440-550 v.

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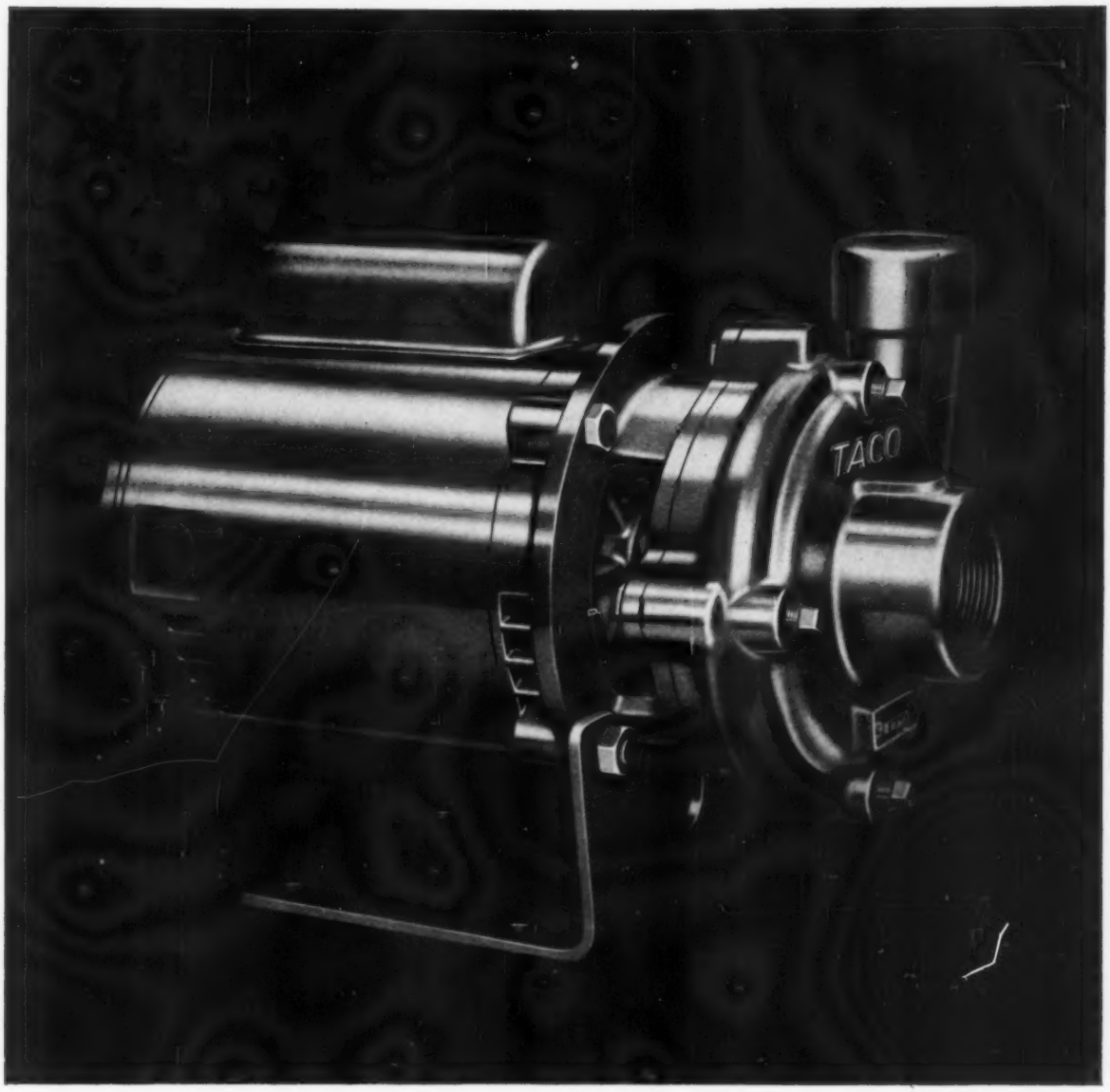

Lubricate in 1970

That's right. If you put the TACO General Purpose Pump into operation today, you can forget about lubricating it until 1970! Actually the motor is permanently lubricated, but we recommend re-packing the bearings every ten years. No other parts of this rugged pump *require* lubrication! Freedom from lubrication worries is just one of many reasons why the TACO General Purpose Pump is ideal for use in air conditioning systems, commercial installations, laundry equipment, swimming pools, and hundreds of other applications. Design has been so simplified that any servicing necessary can be done in the field, with tools ordinarily carried by all service men. Compact and lightweight, the TACO General Purpose Pump saves installation time too. And its dependable performance saves costly "call backs" In short, it provides a better all around return for your investment. Get complete specifications now. All products in the *complete* TACO Line are "efficiency engineered" to provide maximum performance and economy in all your installations. Write TACO HEATERS, INCORPORATED, 1160 Cranston Street, Cranston 9, Rhode Island.

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"Zephyr"-25 "Zephyr"-50

New "Zephyr" containers for "Freon" —lighter in weight, easier to handle

These new "Zephyr" containers for "Freon" refrigerants are shorter, wider, lighter—so much easier to handle that a 50-lb. size is now practical. You can use them upright or inverted without special blocks or stands . . . stack them one on top of the other . . . stand them upright in your truck.

A permanent collar not only protects the valve, but also serves as a built-in carrying handle. And no wrenches are needed, because these new containers also have a new-type handwheel valve. Both "Freon-12" and "Freon-22", the premium-quality refrigerants, are available in these new Du Pont "Zephyr" containers.

New top and valve for standard 25-lb. cylinders

Now, Du Pont's new "Spintop", for standard 25-lb. cylinders, combines a convenient carrying handle, valve protector and stand, all in one. Free to rotate, the "Spintop" provides easy access to the valve. And the valve itself is a handwheel type that includes a special, spring-loaded pressure relief valve for added safety.

Complete family of containers* for "Freon" refrigerants includes the new "Zephyr" types; standard 10, 25 and 145-lb. containers; and the new "Spintop" cylinder. Your *leading* air-conditioning and refrigeration wholesaler stocks the type that suits your needs best. Call him today for your order of "Freon" refrigerants.

**1- or 2-lb. "Can-O-Gas" containers of "Freon" refrigerants are available from the Virginia Smelting Co., our nationwide sales agent and authorized repackager.*

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FREON®
premium quality
refrigerants

you'll want to know...

C. E. C. Board Meets, Considers Broad Agenda

THE RECENT Consulting Engineers Council 4th annual board of directors meeting in Gearhart, Oregon presented a program of wide variety to the delegates from 31 state and regional associations in attendance.

A highlight of the meeting was the distribution of the C.E.C. Manual of Practice for Consulting Engineers. The objective of the manual is the assembly, in one volume, of the general mechanics and recommended principles of performance necessary to the conduct of a successful consulting engineering practice. The manual was prepared by a special committee under the chairmanship of Thomas R. Miles of Portland, Oregon, and includes guidance sections on such subjects as engineer-client relationships, potential client evaluation, information exchange through drawings and specifications, bid-handling, and the organization and operation of a consulting practice. This latter section presents a discussion of fees, employee relations, insurance, negotiation, and a recommended accounting system for use in a consulting office. The manual reportedly will be revised from time to time through the use of member suggestions and future committee reports.

The council directors approved four new Engineer-Architect and Principal Engineer-Associate Engineer forms of contract, presented by the documents committee co-chairman George W. Poulsen, Jr., of Salt Lake City.

Outgoing president Ralph M. Westcott, of Los Angeles, announced the establishment of an emergency committee for the purpose of rebutting recent recommendations from various sources aimed at reducing the role of private consultants in public works projects. Mr. Westcott recently voiced the Council's objections to such plans before U.S. Senate and House of Representatives committees (*You'll Want to Know*, June, 1960.)

Mr. Westcott was succeeded as council president by Hueston M. Smith of Smith-Hanlon-Zurheide-Levy, Inc., St. Louis, at the conclusion of the meeting. Other newly elected officers are Harold P. King, first vice president, Fred-

NEWLY-ELECTED Consulting Engineers Council officers are, seated left to right, George J. Toman, secretary; Hueston M. Smith, president; Harold P. King, first vice president; Frederick K. Steel, second vice president. Standing left to right, Lester L. Bosch, treasurer; and Ralph M. Westcott, immediate past president

you'll want to know

erick K. Steel, second vice president, George J. Toman, secretary, and Lester L. Bosch, treasurer.

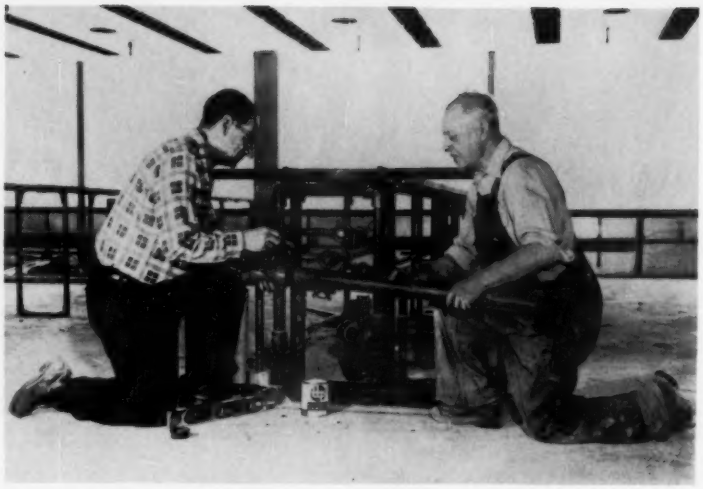
The board effected quick action on pending amendments to the Landrum-Griffin act which, if adopted, reportedly will allow work stoppage at construction sites occupied by a non-union subcontractor's employees. The council interpreted such amendments as conducive to possible forcing of unionization upon private engineering firms. A resolution objecting to the amendments was approved.

Another resolution defining the consultant's role in times of disaster, and calling for an engineer to render services in response to emergency requests "whenever temperate public opinion expects such services" was also adopted.

Further business of the meeting included reports by a number of state associations on local conditions affecting consulting engineers' practice.

Water Heater Standards Approved

THE Fuel Oil & Water Heater Manufacturers Association, Inc., at a recent meeting in Hershey, Pa., adopted recommended Thermal and Mechanical Design Standards covering the following equipment: below water line fuel oil heaters, instantaneous water heaters and converters, ethylene glycol solution converters, steam convertors, and convertor and heat exchangers. The standards will be published in a brochure which will also contain material covering tube side and shell side pressure drop and fouling factors. Further information may be obtained from the Association executive secretary, Edward R. K. Fiencke, 50 E. 42nd St., New York, N.Y.



Use Plastic Pipe For New Dairy Research Laboratory

THE National Dairy Products Corporation's new research and development division building in Glenview, Ill., will be equipped with nearly two miles of UPVC pipe and fittings for corrosive waste drainage and venting, according to Tube Turns Plastics, Inc.

More than a mile of 2 in. Schedule 80 pipe will be used in the building. The sizes of all pipe and fittings in the system range from 1-½ to 4 in. When completed, the system will provide running traps for 144 laboratory sinks, and will handle acids, solvents, and bases used in the facility's analysis work. Injection-molded fittings are used, with most joints being made by the solvent-cemented method. Threaded connections are provided where periodic disassembly is expected, and poured lead joints connect the plastic fittings with cast iron lines. Clevis type hangers, spaced at 6 ft intervals, support the system.

Childs & Smith, architects and engineers, designed the piping system, and Jacob G. Weber Co. was the piping contractor.

Florida County Conducts School Air Conditioning Experiment

AN EXPERIMENT in air conditioned vs non-air conditioned school construction costs is being conducted in Pinellas County, Fla., as reported by the American Air Filter Co.

Previous reports on school construction in various parts of the country have indicated strongly that buildings designed from the outset for complete air conditioning cost no more than similar, but non-air conditioned facilities; but because in all cases only one type was finally constructed, the question remained largely academic.

Now, however, this Florida county is building two schools with identical educational requirements; one of which is designed for air conditioning and the other not.

The designed area of each school will be slightly in excess

of 66,000 sq ft, with the non-air conditioned facility being larger by about 300 sq ft. Base bids for each school were in excess of half a million dollars, with the bid for the air conditioned building being approximately $2000 *less* than its non-air conditioned counterpart. A comparison of the figures shows that the county will obtain the air conditioned school with slightly less gross area for somewhat more per square ft ($8.89 vs $8.80) but at a lower overall cost. Actual available educational area in the air conditioned school will be slightly greater than in the other building.

The Pinellas Park Junior High School — the non-air conditioned building—was designed by architect Charles L. Colwell on a "cluster" plan for maximum breeze cooling, and is heated by a number of small-commercial type gas fired furnaces, serving adjoining classrooms. Rooms in the building are nearly square, and in accordance with Florida requirements for breeze cooling have either windows on two sides or exhaust fans installed. Separate classroom and other buildings are connected by covered, open-air walks. Because of the type of heating system employed, few provisions were required for future expansion, although additional classrooms will probably be constructed, possibly within a year. Heating and ventilating equipment in the Pinellas Park school, on the basis of periodic payments, will cost 67 cents per sq ft, slightly more than one-half the national average.

The Oak Grove Junior High School was designed by architects Bruce and Parrish, New York, specifically as an air conditioned structure. Healy & Latimer, St. Petersburg, were the mechanical engineers. Classrooms are rectangular, with the narrow dimension abutting on corridors. Year 'round unit air conditioners, served by a remote boiler and a compressor, are located on inside walls, where adjoining classrooms are separated by a pipe, wiring, and ventilating air chase. The rooms face covered corridors which are open to the outside, and are connected by a 22 ft wide mall. The cost of installing the year 'round air conditioning system was $1.60 per sq ft, or 93 cents per sq ft more than in the comparison building.

This cost differential was more than made up in lower construction costs, due to design advantages inherent in the air conditioned structure. Both buildings are of concrete block construction with brick facing, and each will contain 16 classrooms plus similar vocational and other facilities.

When outside service facilities, including parking areas, sidewalks, and driveways, are included in the total cost of each structure, the cost of the non-air conditioned school exceeds by $761 the cost of the air conditioned building. Certain additional factors, including special site preparation required at Pinellas Park and an apparent contractor's bid error at Oak Grove that actually lowered the total cost of the building are not considered in the final figures.

Having established the initial cost comparison between the two schools, plans are to continue the experiment to the extent that a comparison will be made between the operating expenses, attendance, extra use of school facilities, and educational effectiveness of each of the schools.

A. V. Hutchinson 1896 – 1960

A. V. HUTCHINSON—"Hutch" to thousands of friends in the heating, ventilating, and air conditioning industry—died June 6 at Stockwell, Ind., where he and Mrs. Hutchinson had made their home in recent months. Named "executive secretary emeritus" of the American Society of Heating, Refrigerating and Air-Conditioning Engineers just a year ago, he had served that society as executive secretary from its merger-formed start a few months earlier.

Mr. Hutchinson was best known as secretary (later executive secretary) and manager of publications of the American Society of Heating and Ventilating Engineers, the name of which was changed in 1955 to the American Society of Heating and Air-Conditioning Engineers. He joined the society in 1922 as manager of publications, was appointed secretary in 1926 and named executive secretary in 1950.

He was born in Brooklyn, N.Y., November 23, 1896 and attended schools in Ridgewood, N.J. He married Janis Louise Barr in 1933, and for many years they lived in Wyckoff, N.J. He served with the Army in 1918 and 1919, and was a member of the Society of American Military Engineers as well as of the American Legion.

His loss will be keenly felt by the industry he served so well during his 37 year career. This is particularly true on the part of Heating, Piping & Air Conditioning's staff, many members of which worked closely with "Hutch" over the years.

you'll want to know

Air Force To Study Electronics Cooling

THE USAF Air Research and Development Command's Rome Air Development Center has authorized a broad research program to identify cooling systems that may improve the over-all effectiveness of ground-based Air Force electronic equipment. The study will extend for one year and will be undertaken by Battelle Memorial Institute, Columbus, O.

R. J. McCrory, director of the program, indicated that one goal of the study will be to conceive new cooling techniques, but that the team had been given the "broadest possible specifications" and will consider a wide variety of devices. The assistance of manufacturers will be invited.

Pipefitter Apprentice Contest To Be Held August 15-19 at Purdue

THE United Association Seventh Annual International Contest for Pipe Fitting will be held August 15 through 19 at Purdue University, Lafayette, Indiana.

Procedures for the contest, as set forth in the U.A. "Contest Rules," prepared by the International Joint Pipe Fitting Apprentice Contest Committee, require that each participant in the international contest be a winner of a State or Canadian Province contest. Only one such contestant from each of the above areas will compete. Contestants in the state and provincial contests, already held, were in turn winners of local competitions, sponsored by the Joint Apprenticeship Committee or local union officers.

The contest is open only to fifth-year apprentice members of local unions in the United Association. It will consist of both written and performance tests, for which first, second, and third-place awards will be announced at a dinner on August 19, at Purdue University.

Snow Melting System Saves Dollars For New York State

THE State of New York Education Department has obtained a considerable saving in tax dollars at its headquarters in Albany by melting snow and ice from the driveway approach to a new loading dock instead of removing it by mechanical means, according to The Dow Chemical Co.

The drive has a 5.8 percent grade and is located on an exposed side of the building, so that severe traction problems were expected for trucks using the facility during the winter months.

A thermal system consisting of a network of 1 in. pipes laid on 12 in. centers was chosen for the 3500 sq ft inclined portion of the drive. The pipe center line is 6 in. below the surface of an 8 in. concrete slab. The drive is surfaced with 2½ in. of asphalt. The entire system required 2732 ft of 1 in. pipe, installed in four grids with 2, 2½, and 3 in. pipe headers.

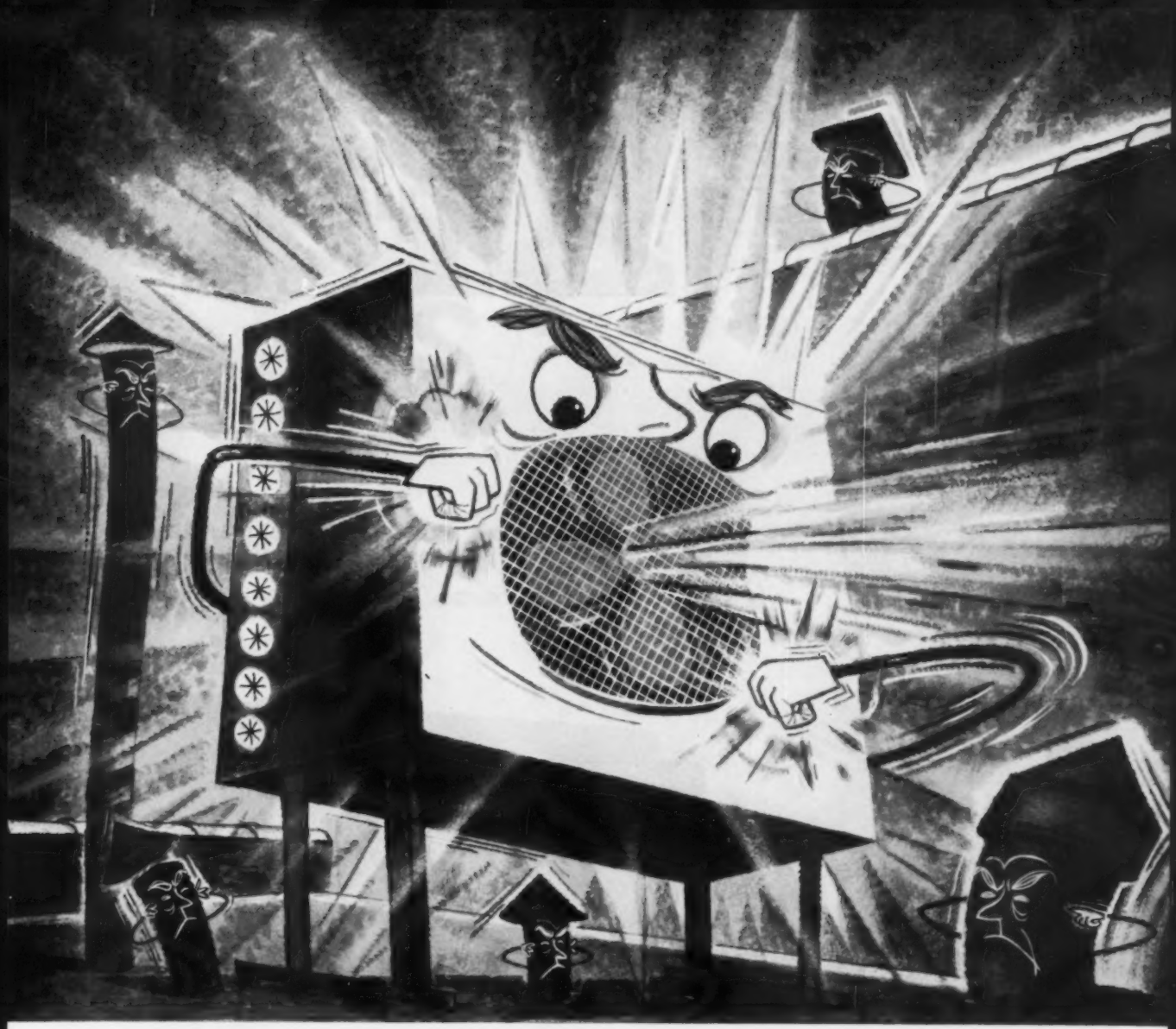
The circulating solution, which is maintained at a temperature of 170 F, is a 44 percent water and ethylene glycol mixture which provides freeze protection down to −20 F during periods of low temperatures when lack of snow allows the system to be idle. Low pressure steam heats the solution.

A centrifugal pump is provided for circulation of the solution, and in addition the grid design allows gravity circulation when conditions warrant.

The system was designed by the Division of Architecture of the State of New York Department of Public Works.

FOUR GRIDS of 1 in. pipe were installed for the sloping drive leading to Education Dept. loading dock in Albany, N.Y.

SUCCESSFUL snow-melting installation provides clear drive and good traction though snow blankets surrounding area



BEFORE YOU BUY, THINK:

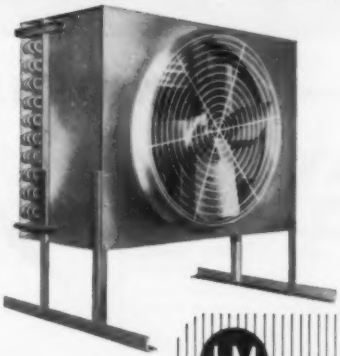
Will your air-cooled condensers sound like thunder?

Not even from close up if they're by Halstead & Mitchell

Fan noise, vibration and rattling have been engineered out of H&M air-cooled condensers. Deep pitch fans are run at slow speeds. Casings are rugged; won't loosen with use.

H&M condensers are completely dependable. The large coil and exclusive Turbu-Flo fins improve heat transfer by up to 15%. Fins are spaced widely to avoid clogging by dirt and other air-borne particles.

Winter operation is easy, too, with H&M's special modulating valve. Halstead & Mitchell air-cooled condensers are available in propeller fan or blower models. Multiple circuiting at no extra cost. Ask your local distributor for complete information, or write to Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.



H&M AIR-COOLED CONDENSER

HM

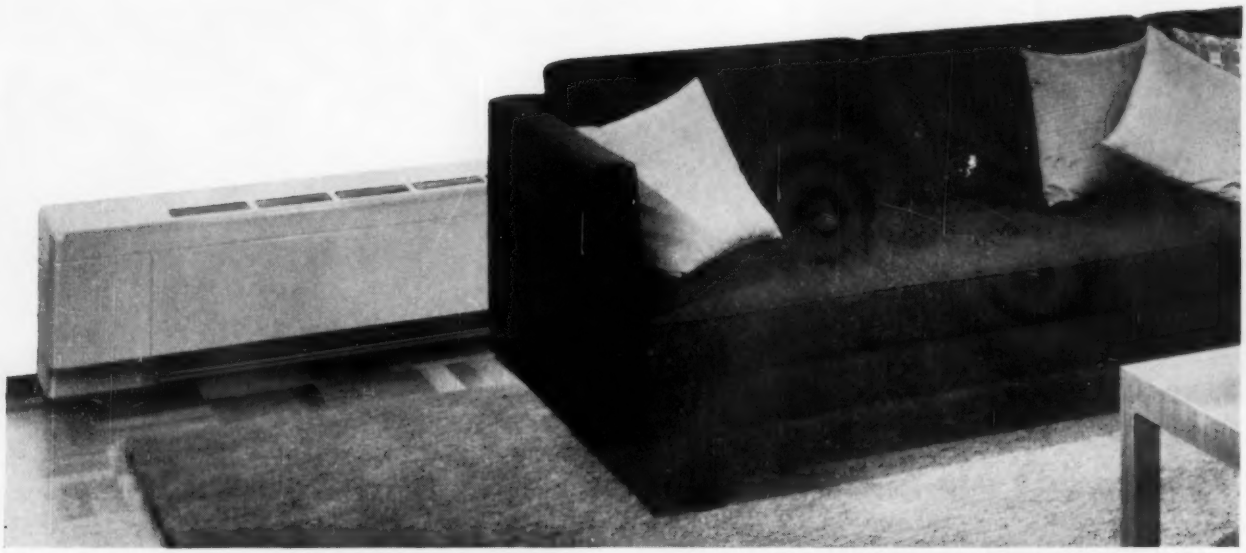
Halstead & Mitchell

Water-Cooled Condensers · Cooling Towers · Air-Cooled Condensers · Finned Coil Products

14½" LOW!

NEW MODINE FAN-COIL UNITS PERMIT FULL-ROOM DECORATING

IN BUILDINGS WITH CURTAIN WALLS



MODINE LOW-BOY *Airditioners*®

Special, nonstandard adaptations of the Low-Boy AIRditioner include provision for above-the-floor concealment of supply and return piping and for uninterrupted wall-to-wall installations. Because quantity, delivery and price are determined on an individual basis, please contact your Modine sales representative or write to the company.

550 LOW-BOYS IN LAKE MEADOWS 600—Modine Low-Boys are providing year-round comfort for residents of Chicago's newest luxury apartment building . . . Lake Meadows 600. This gleaming, glass-enveloped, 12-story and penthouse building overlooks Lake Michigan . . . contains 140 apartments. Owners: New York Life Insurance Co.; Architects and Engineers: Skidmore, Owings & Merrill; Mechanical Contractor: Advance Heating & Air-Conditioning Corp.; General Contractor: Turner Construction Co.

OR FLOOR-TO-CEILING WINDOWS

Modine Low-Boys are never in the way . . . of architect, decorator or tenant. They crouch close to the floor as they heat, cool, filter and dehumidify. The 14½" height is almost a *full foot lower* than other fan-coil units. Although midgets in size, Low-Boys are giants in performance. Using hot or chilled water from a central source, they deliver year-round comfort . . . quietly, economically. They're individually controlled thermostatically or manually. And response is instantaneous!

Handsome Low-Boy enclosures blend with the decor of any room. They're available in 44-, 52-, 68- and 96-inch lengths . . . in six decorator colors: ivory, putty, rose beige, sepia, almond green and dark jade green. Bulletin 760B has complete Low-Boy details. The coupon will send your copy on its way.

A-1411

Modine
MANUFACTURING COMPANY

MODINE MANUFACTURING COMPANY
1509 DeKoven Ave., Racine, Wis.
Please send new Low-Boy Bulletin 760B.

Name.....

Firm.....

Address.....

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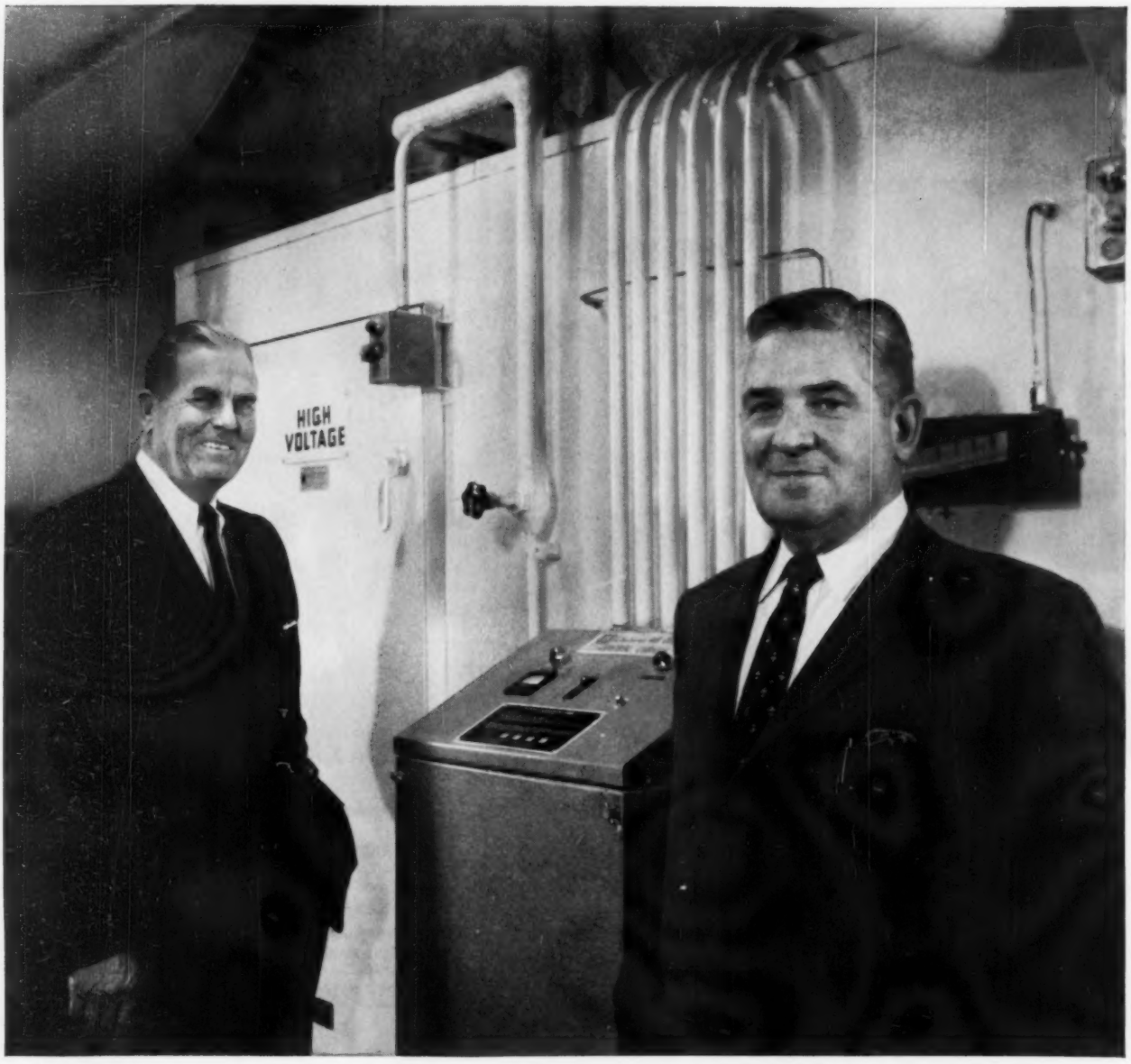
In Canada: Sarco Canada, Ltd., Toronto 8, Ontario

Mr. A. B. Carter and Mr. S. P. Wallace, mechanical contractors for the new Southland Center in Dallas, say:

"Honeywell took all the headaches largest electronic air



Mr. A. B. Carter (left) and Mr. S. P. Wallace in front of a Honeywell Electronic Air Cleaner—one of 17 installed in Southland Center.

out of installing the southwest's cleaning system"

Southland Center, Owner & Builder: Southland Life Insurance Co., Dallas, Texas; Architect-Engineer: Welton Becket & Associates, Los Angeles, New York, San Francisco; Consulting Architect: Mark Lemmon, Dallas; Construction Supervision: Vanguard Corporation, Dallas; General Contractor: J. W. Bateson Co., Inc., Dallas; Mechanical Contractor: Farwell-Wallace, Dallas; Electrical Contractor: Fischback and Moore, Dallas.

Honeywell engineers saw that the equipment was delivered on time—then supervised the installation and thoroughly tested the system to make sure it operated perfectly!

"You can't beat Honeywell's field service organization," agree the contracting team of A. B. Carter and S. P. Wallace. "Honeywell had *project engineers* at the job site from the very beginning. And they stayed on the job until every Electronic Air Cleaner was delivered, installed and checked out at top efficiency!"

Honeywell installed 17 Electronic Air Cleaners in the new $35-million Southland Center. The installation is the largest in the southwest and one of the biggest in the world. It removes 90 per cent of all airborne dirt, to cut cleaning and redecorating costs—supply pure, healthful air throughout the building at all times.

Honeywell also provided the entire temperature control system for Southland Center. The air conditioning plant is the largest of its type now installed in an office building. 1300 thermostats offer individual room temperature control. And two Honeywell Supervisory DataCenters* provide centralized control of public spaces and the vast heating and air conditioning system.

You'll find your job—large or small—much easier when you work with Honeywell. Help is always conveniently available from any one of 112 offices across the nation. Call your local Honeywell office. Or write Honeywell, Dept. AC-7-67, Minneapolis 8, Minnesota. **Trademark*

Honeywell's electronic air cleaning system will keep Southland Center bright and new-looking for years at lowest cost.

Honeywell

First in Control

SINCE 1885

75th YEAR PIONEERING THE FUTURE

WHY DO MORE AND MORE SPECIFICATIONS CALL FOR Phillips COOLING TOWERS?

BECAUSE THEY ARE THE ONLY COOLING TOWERS CUSTOM ENGINEERED!

for the correct solution to your problem... specify

Phillips CUSTOM ENGINEERED COOLING TOWERS

It stands to reason—every water tower installation has different problems. It may be noise... freezing... space... maintenance... atmospheric conditions... or any other. There is no stock answer to varying job conditions.

That's why every day, more and more specifications call for PHILLIPS CUSTOM ENGINEERED COOLING TOWERS. Here are towers designed to give you the most efficient... most economical solution possible for your particular problem.

Put PHILLIPS... the cooling tower specialists with unrivaled experience to work on your next job. You'll like the results.

EVERY STEP CUSTOM ENGINEERED

CASINGS
Selection of material to fit Architectural treatment and surrounding conditions.

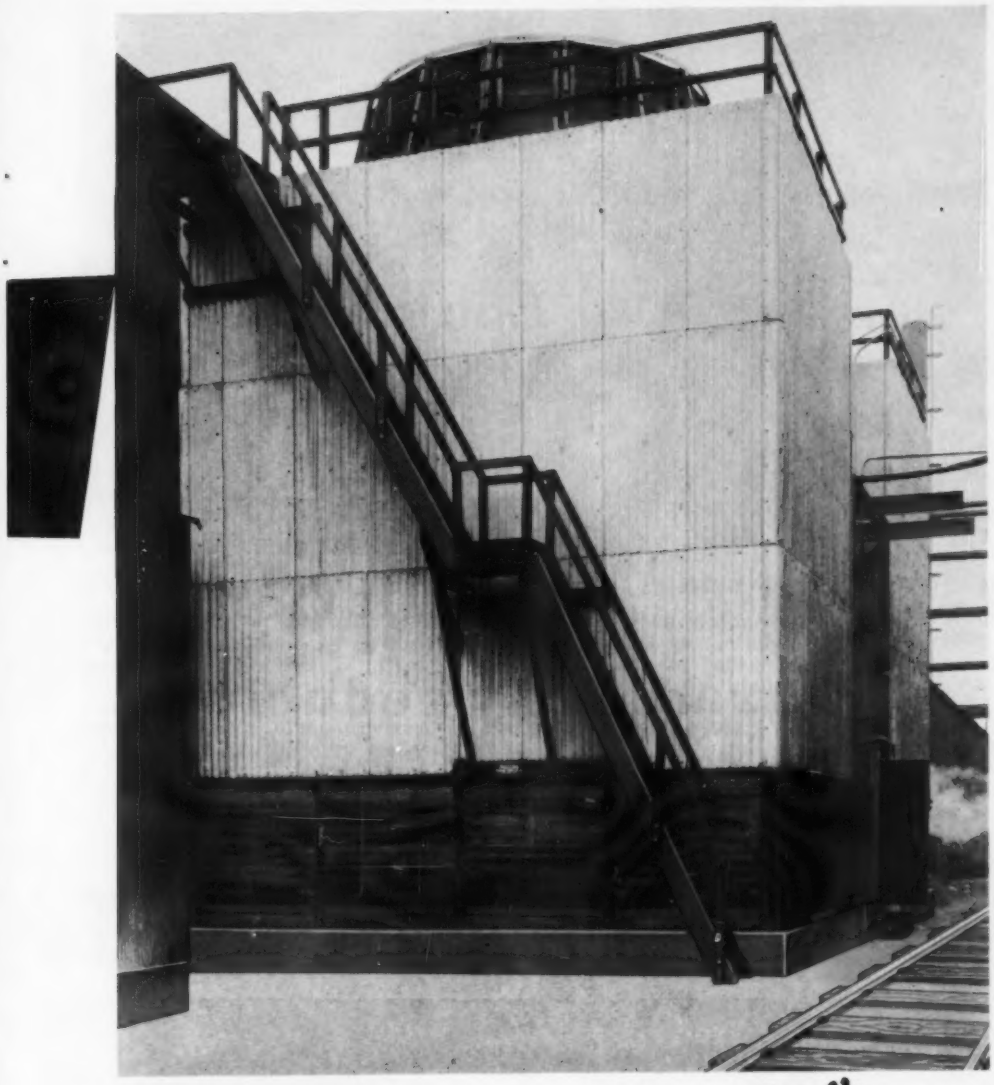
BASINS
Redwood, stainless steel, galvanized steel, carbon steel up to and including ¼" thickness with any desired coating, reinforced concrete basins supported on steel beams.

DISTRIBUTION SYSTEM
Spray nozzle type or open Weir gravitational type system.

FANS
Multi-blade, adjustable propeller type fan in cast aluminum, stainless steel or Monel. Either direct driven fan in small sizes or indirect right angle worm gear drives.

FILL
Redwood or pressure treated Douglas Fir. Slip-fit, self-supporting for easy removal for interior maintenance.

FRAMEWORK
Hot dipped galvanized structural steel .250" minimum thickness. Redwood or pressure treated Douglas Fir.



Midvale-Heppenstall Co.
Nicetown, Philadelphia, Pa.

Consulting Engineer:
Swindell-Dressler Corp.
Pittsburgh, Pa.

another problem solved by: Phillips CUSTOM ENGINEERED COOLING TOWERS

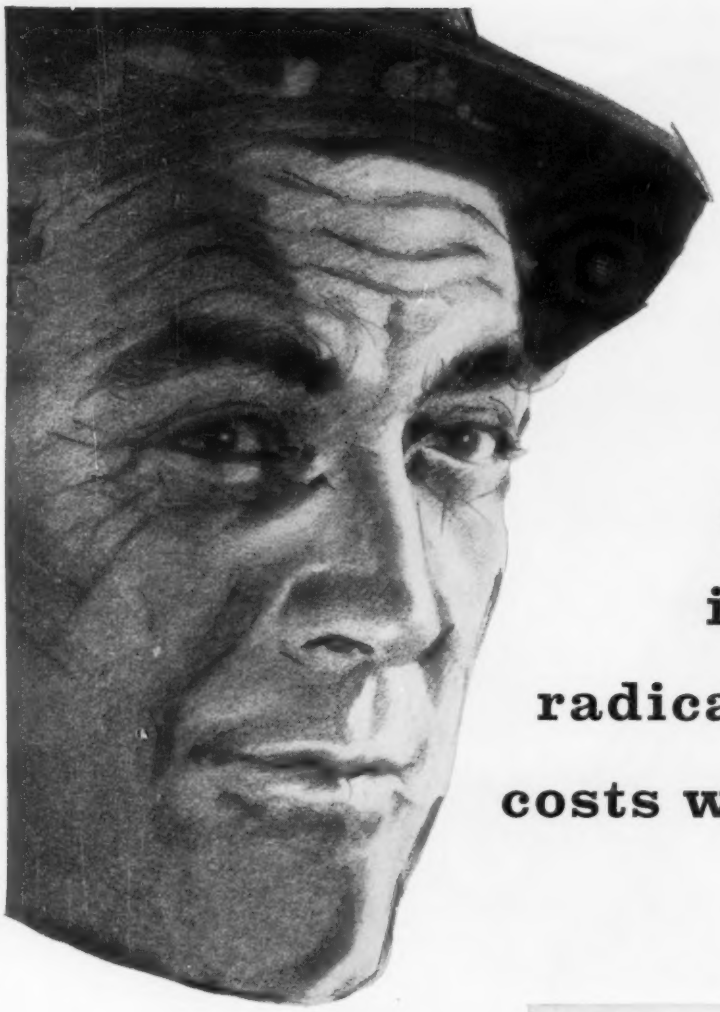
the problem – To fit a cooling tower of 4,000 gallons capacity in a small space between an odd-shaped mill building on one side and a railroad siding on the other.

the solution – A PHILLIPS CUSTOM-ENGINEERED COOLING TOWER, using every square foot of available space and conforming to the shape of the building, was designed for this installation.

SPECIAL FEATURES ON ALL TOWERS

Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

WRITE FOR LITERATURE



Look at how contractors are speeding installations, radically reducing costs with Greenlee

JOB-

As the bidding gets tighter and the profit squeeze grows tougher, today's smartest contractors are "tooling up" in every practical way to streamline operations — and to *control* costs!

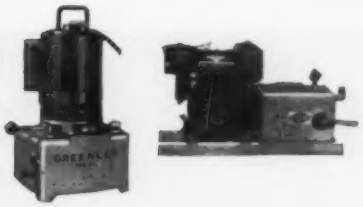
Many are finding the answer in *Job-Profit Tooling* by Greenlee. It mechanizes much of the work previously done by hand, saves costly materials — assures extra efficiencies, better final results, *more net profit per job!*

To illustrate — the Greenlee Lightweight Hydraulic Pipe Bender at right makes a 90° bend in 3" pipe in approximately one minute, with *one ram stroke.* Models available for making any bend up to 90° in ½" - 2"; ½" - 3"; ½" - 4"; and 1¼" - 6" pipe. Attachments available for bending steel, copper, brass, and aluminum tubing. See facing page for other ways to save time, cut costs with Greenlee Job-Profit Tooling.

For fast installation of underground pipe

With a Greenlee Hydraulic Pipe Pusher on the job you quickly, easily push pipe underground . . . without tearing up pavement, sidewalks, tracks, floors, lawns. Eliminates extensive trenching, tunneling, backfilling and repaving. Just a short trench accommodates the pusher to save you hours of excavating work. Greenlee Hydraulic Pipe Pushers are extensively used to make underground installations of pipe for gas, water supply, industrial processes, and other purposes; conduit for electricity and telephone cable. Many owners report that this equipment often pays for itself in labor savings alone on the first few jobs.

Pipe Pusher No. 790 for ¾" - 4" pipe sizes. Six speeds, up to 40 tons pushing pressure. Average pushing speed 2 feet per minute when equipped with No. 797 power pump. Pipe Pusher No. 795 for pipe larger than 4", concrete sewer and corrugated drainage ducts. Six speeds, up to 75 tons pushing pressure. Both models can be operated with hand or power pump.



For faster operation of pipe benders, pushers — Convert from hand to power pump. Many contractors are finding the value of power operation over their previous hand-operated equipment. Power pumps increase pipe bending speed from 3 to 5 times, proportionally increase pipe pushing speed. A complete line of Greenlee hydraulic power pumps available with electric motors or gasoline engines — in various models to meet your job requirements — all with 10,000 psi maximum pressure. Illustration above (left) shows the popular Greenlee No. 798 AC-SA pump with ¾ hp, 110-220 volt a-c electric motor. (Right) No. 797-G-SA pump with 4½ hp gasoline engine. Also available with rubber-wheeled undercarriage.

PROFIT TOOLING

For bending small pipe — New Greenlee Ratchet Benders speed and simplify bending of pipe (½" - 1½") with ratchet action that permits short, powerful strokes. Makes any bend up to 90° and is equipped with built-in bending gauge, 0° to 90°. Swing-away pipe clamp permits fast, easy loading. Can be operated on its T-iron base or equipped with standard pipe legs as shown at left. Two models: No. 1800 for ½", ¾", 1" pipe, No. 1801 for 1¼", 1½" pipe.

Also available from Greenlee, hand benders for fast, easy bending of copper, brass, and aluminum tubing. Copper tube benders make bends up to 90°. Tubing and pipe benders make bends up to 180°. Various models and sizes.

For boring pipe-size holes —Greenlee multispur bits bore holes in wood for following sizes of pipe: ½", ¾", 1", 1¼", 1½", 2". Use with power drill or bit brace. Sets of six packed in metal box.

Write for new illustrated quick-reference Bulletin E-240.

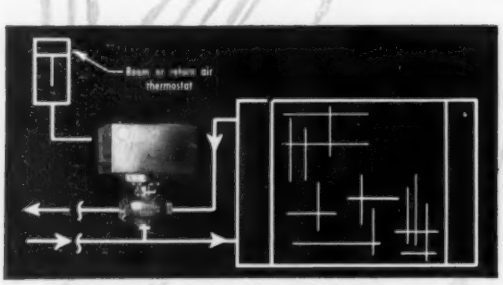
GREENLEE TOOL CO.
1887 Columbia Ave., Rockford, Ill.

TOOLS FOR CRAFTSMEN
GREENLEE

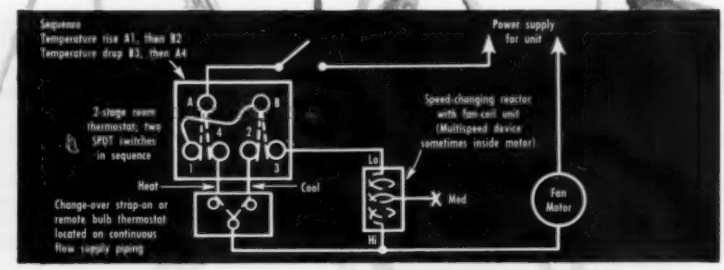
JOB-PROFIT TOOLING

. . . cost control for contractors

Tips on control

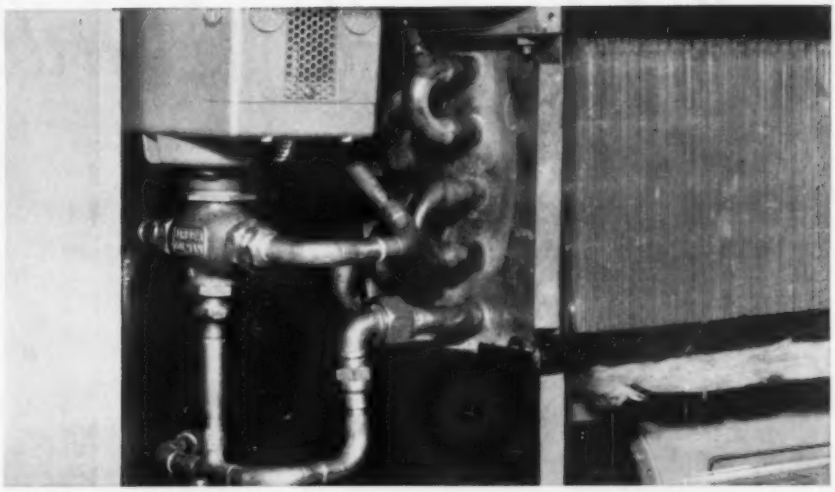


Fan-coil control with continuous fan operation and thermostatically controlled Barber-Colman transistorized coil valve.


Sequence
Temperature rise A1, then B2
Temperature drop B3, then A4
Power supply for unit
2-stage room thermostat; two SPDT switches in sequence
Speed-changing reactor with fan-coil unit (Multispeed device sometimes inside motor)
Heat
Cool
Lo
Med
Hi
Fan Motor
Change-over strap-on or remote bulb thermostat located on continuous flow supply piping

Elementary diagram of two-stage fan speed control for fan coil units with automatic summer-winter change-over. Descriptive literature with schematic control diagrams available upon request.

# of fan-coil units



Proper automatic control is essential to user satisfaction. Here are facts to consider in selecting control hookups for heating, or heating and cooling installations.

Fan-coil units consist basically of a cabinet, fan, and motor, and a finned heat transfer surface through which hot or chilled water may be circulated. Satisfactory heating and cooling performance can be assured with proper *automatic* controls. (*Manual* on-off operation has frequently been the cause of inadequate performance and dissatisfaction.)

Four basic types of control systems are commonly used:

1. Proportional control using a coil valve and thermostat. In most cases this is the ideal control method. It represents a "high-quality job" and provides excellent temperature uniformity. Also, the fan operates continuously, avoiding the disadvantage of changes in sound level.

A three-way valve may be used on the coil, but a two-way valve should be considered because it provides superior throttling performance. When a two-way valve is used, a means of regulating the supply main pressure should be provided.

2. On-off control using a coil valve and thermostat. This type of control has the advantage of continuous fan operation with the coil valve opening or closing by thermostat control. When a motor-operated valve is used, two-position valve control is simple and dependable. Excellent results are produced at a cost slightly less than for proportional control. Normally, however, it does not provide quite as accurate control of temperature uniformity as proportional control.

3. Room thermostat control of fan only. This is the simplest automatic control system for fan-coil units. However, when used for cooling, it may introduce the possibility of condensation with resultant dripping of water. This disadvantage can be avoided or, in some instances, eliminated by using a two-stage thermostat which minimizes the fan-off time. The two-stage thermostat also improves control performance.

4. Combination control using a two-stage thermostat controlling the fan and a two-position coil valve in sequence. This control system is more refined than No. 2 or 3 above. It eliminates the possibility of condensation encountered when only the fan is cycled.

Circuits are arranged for continuous fan operation. Upon the initial call for heating or cooling, the coil valve opens and the fan runs at low speed. When additional heating or cooling is required, the fan is shifted to the higher speed by a two-stage thermostat.

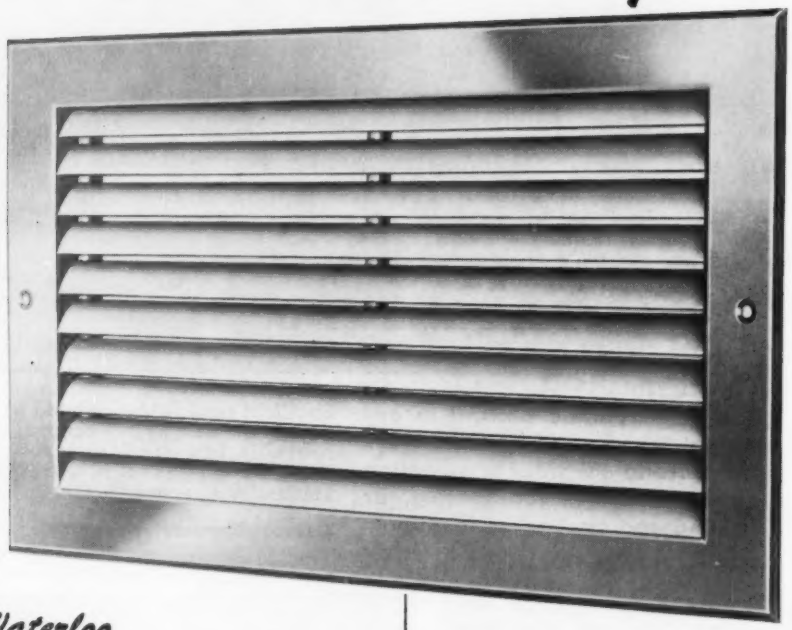
Outdoor reset of winter supply water temperature is recommended to provide optimum results during heating operation with any of the above-described systems.

For complete data, ask for "Application Manual Brochure on Control of Fan-Coil Units."

BARBER-COLMAN COMPANY

Dept. G, 1101 Rock Street, Rockford, Illinois

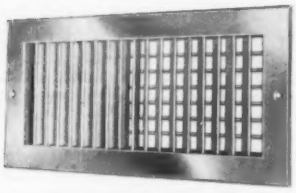
WATERLOO
Return Air Grilles



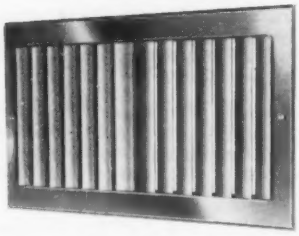
MODEL
3HD

Waterloo Offers a Complete Line

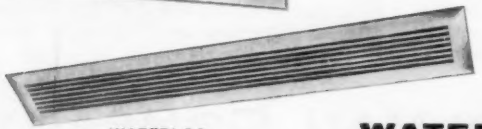
TYPICAL WATERLOO UNITS:



WATERLOO
SUPPLY
GRILLES
★
MODEL
2V



WATERLOO
CURVED
LOUVER
GRILLES
★
MODEL
1 CV2



WATERLOO
AIRLINE GRILLES
MODEL AL1

WR-118

Rugged Construction Smooth Contoured Fins

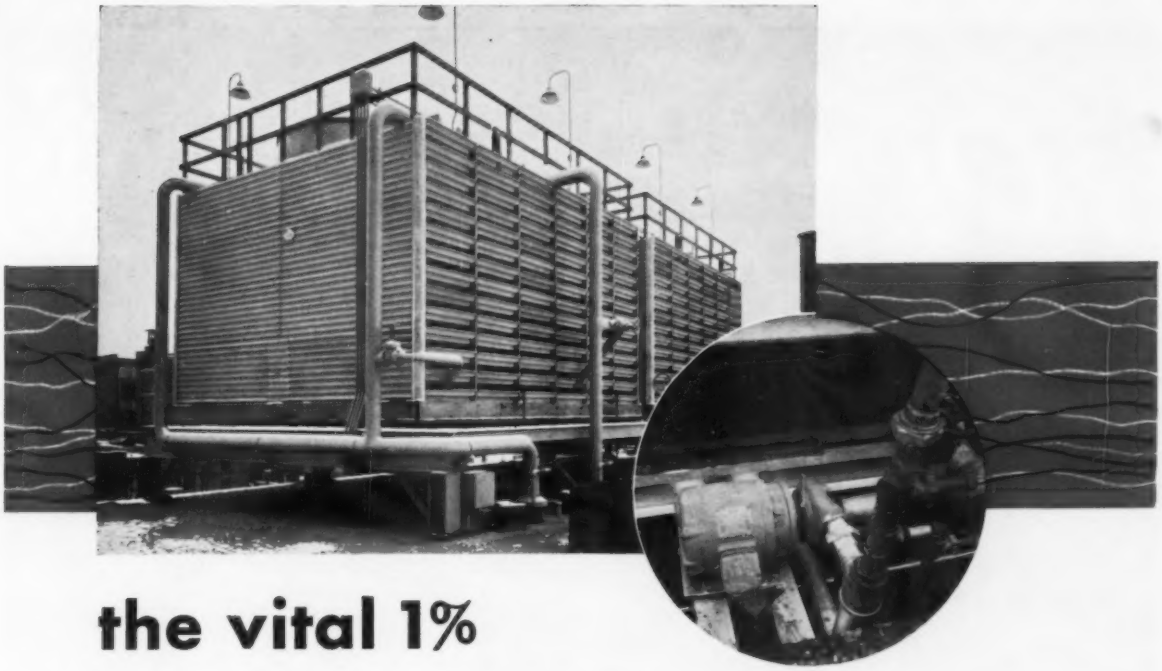
Waterloo Series 3 *return air grilles* are ruggedly constructed for commercial installations. The smooth contour of the fin results in a nearly sight-proof grille without decreasing the free area. Where straight deflection is desired, the fins are also hemmed at the edge for added protection. Waterloo *return air grilles* are available with either horizontal or vertical fins.

Series 3 *return air registers* feature the same rugged construction and incorporate the use of the opposed blade damper. This may be snapped on or off the unit and is adjustable from full open to closed for balancing of the air system.

WATERLOO
Air Diffusion
EQUIPMENT

Write for the comprehensive catalog which gives complete data.

WATERLOO REGISTER COMPANY, INC.
P.O. BOX 72, WATERLOO, IOWA



the vital 1%

In an air conditioning installation, the pump seldom exceeds 1% of the total cost, but the importance of this 1% is obvious . . . if the pump breaks down, the entire system fails. The proven dependability and lower maintenance costs of Ingersoll-Rand Motorpumps are only two reasons why they are the leader for such important applications. I-R Motorpumps simplify installation because they are compact. They operate in any position and they are available in a wide range of types and sizes to meet any requirement.

a century 1860 ~ 1960 *of pump progress*

from the leading manufacturer . . .

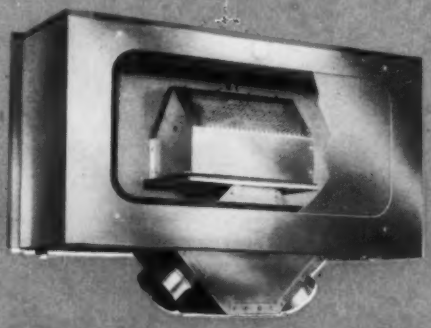
Ingersoll-Rand

81A9 11 Broadway, New York 4, N. Y.

"K" line Motorpumps for smaller installations are available ⅓ through 25 HP.

OTHER I-R PUMPS AVAILABLE

Self-priming pumps | Horizontally split pumps | Cradle mounted pumps



DUAL-DUCT...
UNOBTRUSIVELY EFFICIENT

The mark of fine air conditioning is its unobtrusive efficiency. It cools in summer, warms in winter, always maintains proper conditions...and there are no visible ducts or room units. This description fits Dual-Duct to the letter. Air mixing units, built by the pioneer and leader in high velocity air conditioning, may be concealed overhead in the ceiling or below windows. Volume is readily adjusted upon installation, or, if preferred, it may be pre-set at the factory to your specifications. Either way, there is never a balancing problem with Buensod Dual-Duct thanks to exclusive Automatic Volume Control which maintains constant air volume regardless of variance in static pressures. So whether your next installation is for a new structure or a renovation, make it a Buensod Dual-Duct installation.

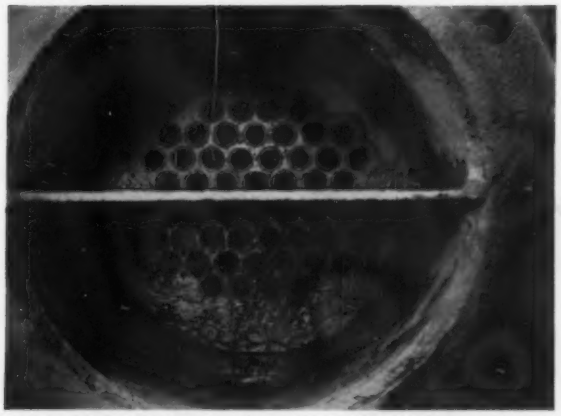
BUENSOD DUAL-DUCT

BUENSOD-STACEY

BUENSOD-STACEY CORP., 45 West 18th Street, New York 11, N. Y.
A subsidiary of Aeronca Manufacturing Corporation

Descale cooling towers, evaporative condensers, ice-making machines rapidly, effectively with **dry acid** cleaners based on **Du Pont Sulfamic Acid**

SAFER, EASIER TO USE. Dry acid cleaners eliminate hazards of handling liquids, particularly where carboys are involved. These cleaners can be added directly to sump of cooling tower or evaporative condenser . . . dissolve scale fast—destroy algae, too!



LESS CORROSIVE. For descaling condenser tubes (above) and other parts, sulfamic cleaners are less corrosive than liquid cleaners . . . on brass, 60% less; on steel, 70%; copper, 85%; aluminum, 95%. Many sulfamic cleaners can be used safely on galvanized steel.

LOWER HANDLING COSTS. This 100-lb. drum of dry acid cleaner is more than equivalent to this carboy of inhibited muriatic acid weighing 192 lbs. You'll save on shipping, handling and storage expenses. And no deposits because drums are disposable.

NON-FUMING. These dry acid cleaners produce no corrosive gases, either dry or in solution. No harmful fumes to cause corrosion in vapor spaces of equipment or damage to electrical and operating parts . . . and never a toxic fume problem to personnel.

Ask your supplier for safer, effective cleaners based on Du Pont Sulfamic Acid or mail coupon for additional information and names of formulators who offer these compounds.

E. I. du Pont de Nemours & Co. (Inc.)
Industrial and Biochemicals Department, N-2533-HP
Wilmington 98, Delaware.

Please send me ☐ sulfamic acid general equipment cleaning bulletin, ☐ names of formulators offering cleaners based on sulfamic acid.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

DU PONT
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WHEEL HANDLE

GRADUATED

LOCK AND SHIELD

ANGLE PATTERN

GLOBE PATTERN

CORNER PATTERN (Sectional Below)

MARSH THERMOSTATIC RADIATOR TRAPS

ANGLE PATTERN

STRAIGHTWAY PATTERN

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CUT OPEN VALVE

F&T TRAPS

No. 12, REPRESENTATIVE OF WIDE LINE

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No. 5 VENT, ONE OF MANY

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No. 500 INVERTED BUCKET TRAP

All the best of their kind!

You probably have made certain Marsh products your standbys without realizing there are a lot more of them just as superlative as the ones you like so well.

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Four Ranges
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Get the most from your pump investment

A standard type Skidmore Pump will meet the exacting requirements

There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.

TYPE UV

Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

Write for *Bulletin No. 19-A*

TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

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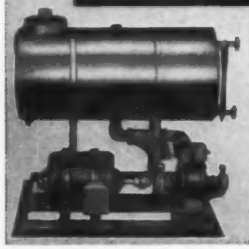

TYPE TM

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

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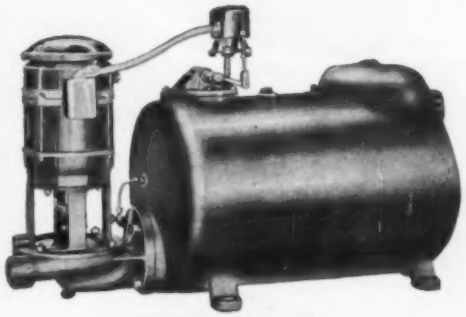
Vertical Condensation Pump



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Dekoron products are first in the field for wide selection . . . quality . . . service . . . new product development. And the New Poly-Cor is the latest development to make instrument tubing news.

For here is a superb instrument line harness of exceptional quality with features never before available. Check them carefully. New grade of all-black polyethylene for operation at higher temperatures . . . number coding of tubes for easier hook-up . . . Mylar® vapor barrier . . . lighter weight. All these features are now standard in New Poly-Cor — and at no increase in price.

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EASIER INSTALLATION

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Vertical Multizone Unit

Thermal Units Air-Condition Huge Vocational School

The Lindsey Hopkins Vocational School in Miami, Florida, is believed to be the nation's largest and most successful adult vocational school with an enrollment of about 39,000. The building pictured above houses most of the classes which meet during the daytime and evening. Fifteen of Thermal Engineering's horizontal central plant type and multizone air conditioners maintain the comfort level in these busy classrooms.

From Presque Isle, Maine to Miami, Florida, and across the nation to the Pacific, Thermal Engineering's equipment is meeting the demand for year 'round comfort in all types of structures, under many varying climatic conditions. Its performance and quality assure architects and engineers that this equipment can be specified with confidence.

For finer air conditioning and ventilating equipment for every climate to fit all architectural requirements, you can specify Thermal. The Thermal line includes central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers. We will be glad to furnish you our complete catalog.

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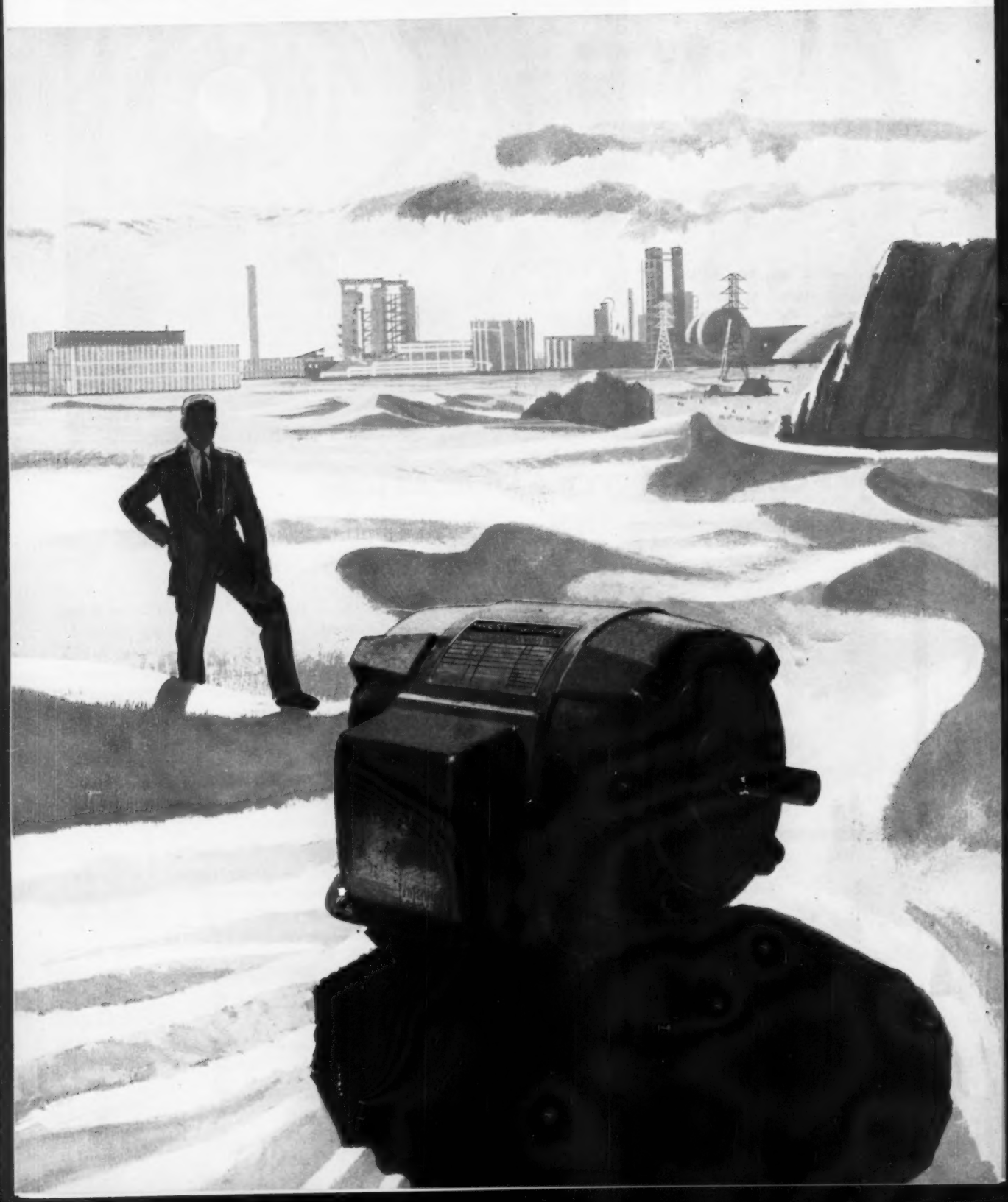
AGENTS IN PRINCIPAL CITIES

New Guardistor

THE MAN & THE MOTORS



FROM WESTINGHOUSE

Guardistor motors let you match the full capability of the motor to the job— with complete safety—absolute confidence

Our Marketing Manager says:

- "You can match the motor to the load . . . use all the motor you are paying for.
- Provides positive protection based on winding temperature . . . *not* load current and/or power supply fluctuations.
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Our Engineering Manager says:

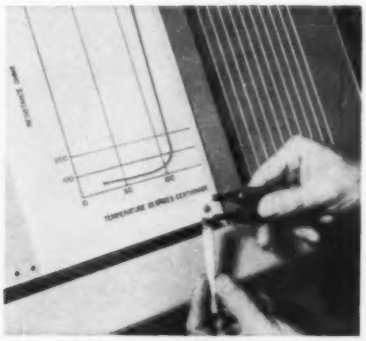
"With the breakthrough development of the Westinghouse Positive Temperature Coefficient thermistors, for the first time we can provide inherent protection against motor failure caused by excessive heat. The solid-state thermistors buried in the windings instantly sense excessive heat from any cause and simultaneously warn of trouble or automatically take the motor off the line. Thus, motor protection is placed where only true motor protection can be . . . in the windings."

Call your Mr. Westinghouse for the application of a Guardistor* motor to your drive requirements . . . write for *Questions and Answers About . . . Guardistor* (B-7876). Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

*Trade-Mark

J-22160

Unlike remotely located sensing devices, PTC thermistors are buried in the windings of the Guardistor motor, instantly equating all temperature factors.



Ever alert PTC thermistors constantly totalize temperature, statically triggering an action *only* if critical temperature is reached.

MOTOR & GEARING DEPARTMENT

YOU CAN BE SURE...IF IT'S

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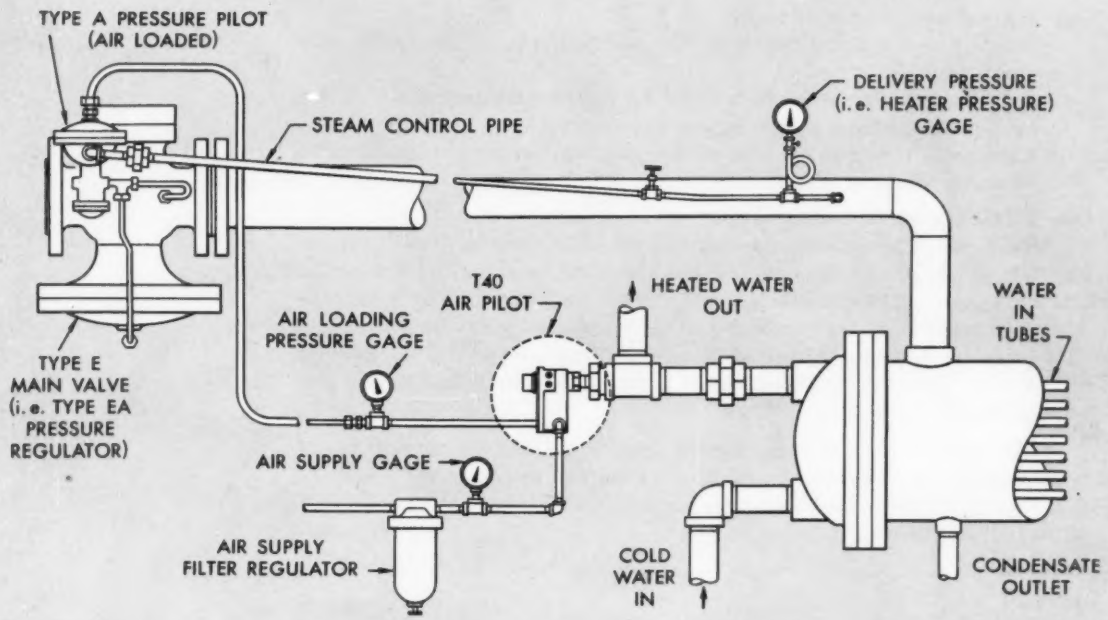
New Spence Temperature Control System Gives Unusual Control Accuracy


TYPE A PRESSURE PILOT (AIR LOADED)
STEAM CONTROL PIPE
DELIVERY PRESSURE (i.e. HEATER PRESSURE) GAGE
T40 AIR PILOT
HEATED WATER OUT
WATER IN TUBES
AIR LOADING PRESSURE GAGE
TYPE E MAIN VALVE (i.e. TYPE EA PRESSURE REGULATOR)
AIR SUPPLY GAGE
AIR SUPPLY FILTER REGULATOR
COLD WATER IN
CONDENSATE OUTLET

TYPE EAT40 AIR-CONTROL TEMPERATURE REGULATOR (Patent Pending)

In a recent installation the new Spence air-control temperature regulating system provided:

- ±5°F control accuracy under wide and instantaneous load swings of 210 to 80 gallons per minute.
- Up to 50% reduction in cost as compared to instrument systems of similar accuracy.

This unique cascade-type control with throttling range adjustment independent of maximum heater pressure was developed to meet today's demand for greater control accuracy.

Additional features of the new Spence Temperature Control System include:

- 200°F wide adjustable temperature range
- Adjustable speed of steam pressure change
- Over and under temperature protection
- Pressure limit control
- Fast response
- Very low air consumption
- Field reversible for heating or cooling

The Spence Type EAT Air Control Temperature System, when properly installed, will tame wide ranging, fast changing loads of instantaneous heaters and modern heat exchangers. The cascade principle plus the use of an extremely fast responding bi-metal temperature sensing element reduce time lags and provide control stability.

Here's how the new Spence system operates:

Quick response is based on a bi-metal temperature sensing element.

Temperature pilot continuously regulates a loading air pressure.

This loading signal, when applied to a pressure regulator to reflect heater temperatures, causes it to adjust the main valve as changes in load require.

Spence has also developed a new pressure control system based on this same cascade principle. This system has a control accuracy of ½ psi or better from positive pressures through the vacuum range to 30" Hg.

For complete information on these new air controlled temperature and pressure control systems, write for your copy of Bulletin 9.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York
SE-148

Now available

ANACONDA® ACR
Copper Tube (Type L) for Air Conditioning and Refrigeration

Cleaned, Dried, Capped, Color-Coded, Marked ACR.

This new Anaconda product is available in 20-foot straight lengths, hard temper, in standard nominal sizes from ¼" through 6". The color of stripes and lettering is blue, consistent with the color code for Type L. The caps are yellow for quick identification.

Anaconda also now offers a broader range of sizes of Copper Refrigeration Tube in coils—dehydrated, ends sealed, and uniformly soft temper. Anaconda Refrigeration Tube is available now in sizes from ⅛" O.D. through 1⅜" O.D.

When you order copper tube from your wholesaler be sure to specify Anaconda ACR Tube, Anaconda Refrigeration Tube and Anaconda Fittings, products of The American Brass Company, Waterbury 20, Conn.

ANACONDA®
COPPER TUBE AND FITTINGS

Made by The American Brass Company

Why a Steam Trap Has to Handle "Air"

Low temperatures and corrosion of equipment are often evidence of inadequate trap air venting capacity

Air, with its load of oxygen and carbon dioxide, has an unwholesome habit of interfering with the efficiency of steam heated units. If steam were always free of these undesirable companions, things would be a lot simpler for men-who-operate-plants. Because it isn't, three unhappy situations frequently occur:

1. ***Operating temperatures are subnormal.*** This is a two-part problem. First, an air-steam mixture has a lower temperature than pure steam at the same pressure—see Table A. Secondly, air can "plate out" on heat transfer surfaces as shown in Figure 1. Under some conditions, such an air film will knock down heat transfer efficiency by as much as 50%.

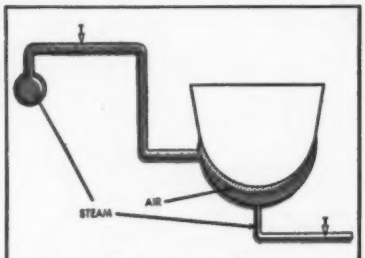


Fig. 1. *How air can "plate out" on heat transfer surfaces. This "insulation" drastically reduces heat transfer efficiency. Armstrong trap operation creates turbulence in the equipment that prevents this.*

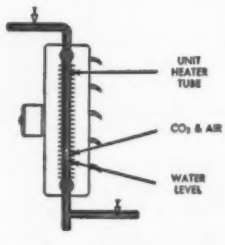


Fig. 2. *Corrosion occurs when units are not kept continuously free of both condensate and air. Armstrong traps discharge both,* at steam temperature, *as fast as they accumulate.*

2. ***Corrosion rears its ugly head.*** Oxygen and carbon dioxide are real trouble-makers. CO_2 gas goes into solution in condensate, forms carbonic acid and chews away at vulnerable metal sections. O_2 aggravates situation. See Figure 2.

TABLE A—How air reduces steam temperature.

Gauge Pressure	Temp. of Steam with No Air Present	Temp. of Steam Mixed With Various Amounts of Air (% Air by Volume)	
		10%	30%
10.3	240.1	234.3	220.9
25.3	267.3	261.0	246.4
50.3	298.0	291.0	275.1
75.3	320.3	312.9	295.9
100.3	338.1	330.3	312.4

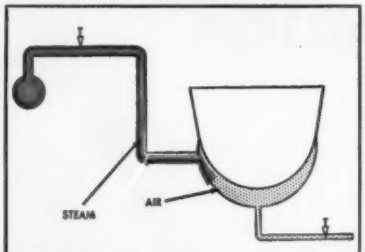


Fig. 3. *When steam is turned on, it takes a trap with extra air venting capacity to provide fast heat-up.*

3. ***Heat-up is slow as a snail.*** Air has a picnic in units that are shut off periodically. Figure 3 pictures the problem. Lines and equipment literally fill up with air. When the steam is turned on it can get in only as fast as the air gets out.

Enter Steam Traps

Curing these steam system ailments involves an operation sometimes called a "trap transplant." It consists of removing traps that don't get the air out and replacing them with traps that do.

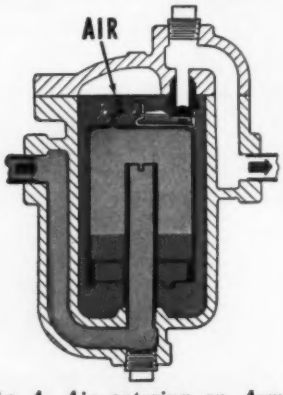
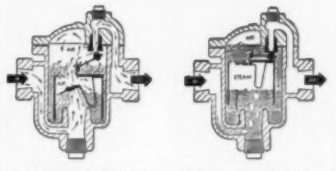


Fig. 4. *Air entering an Armstrong trap passes through the bucket vent and accumulates in the top of trap. When trap opens, air is discharged along with condensate.*

Figure 4 shows how an Armstrong inverted bucket trap continuously vents air. What the picture doesn't show is a built-in plus-value of this trap's design. An Armstrong trap opens suddenly, creating a momentary pressure drop and turbulence in the unit being drained. This breaks up air films and "pumps" air down to the trap so it can be vented.

The vents in standard Armstrong trap buckets will pass all the air normally encountered. In special cases, such as paper machine dryers, the vents are correctly sized larger at the factory to meet the requirement.



Thermostatic vent open. *Thermostatic vent closed.*

Fig. 5. *Open float with thermostatic vent for off-and-on units. When trap is cold, vent is open, permitting air to blow through when steam is turned on. When steam reaches trap, heat closes thermostatic vent. Then, regular bucket vent handles all air coming in with steam.*

Open Float with Thermostatic Vent

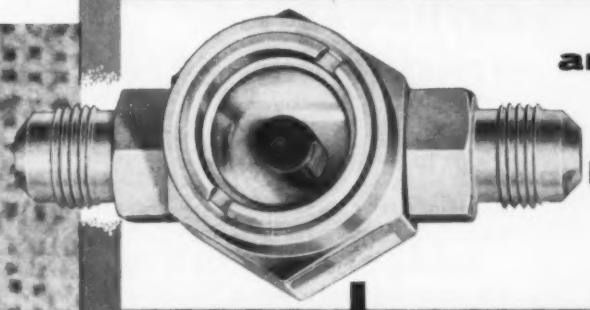
Super air-venting capacity is a must for fast heat-up of low pressure unit heaters, heating coils, steam headers and other units that are on-and-off. Figure 5 shows how the Armstrong open-float-with-thermostatic-vent trap takes care of this.

* * *

The 44-page Armstrong steam trap book covers other features of the Armstrong trap as well as its excellent air handling characteristics. This catalog also discusses trap selection, installation and maintenance. Your local Armstrong Representative or Distributor will be glad to give you a copy. Call him, or write Armstrong Machine Works, 8741 Maple Street, Three Rivers, Michigan.

ARMSTRONG STEAM TRAPS

Check these SPORLAN See•All firsts



and you too will demand this combination Moisture and Liquid Indicator!

- One indicator for Refrigerants 12-22-40 & 500. Green always means dry. Chartreuse is the caution signal, and when the indicator turns to Yellow, the system is too wet!
- Color changes are easily distinguished and reversible.
- An indicator protected from discoloration and washing by a filter pad.
- Color change point that is reliable and accurately calibrated as to temperature.
- Can be installed anywhere in the liquid line.
- A full-view sight glass available with either flare or sweat connections.
- Double gasket – each a molded wedge providing a positive leakproof joint.
- Disassembly not required during installation.

***Ask** your friendly Sporlan Wholesaler for Bulletin 70-10 for complete details on the Sporlan See•All.*

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7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI
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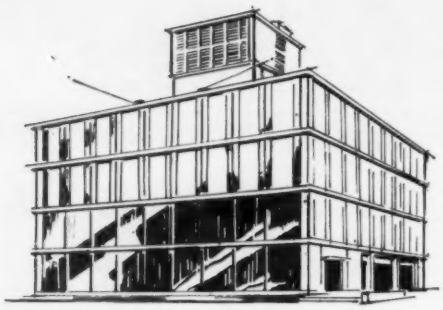
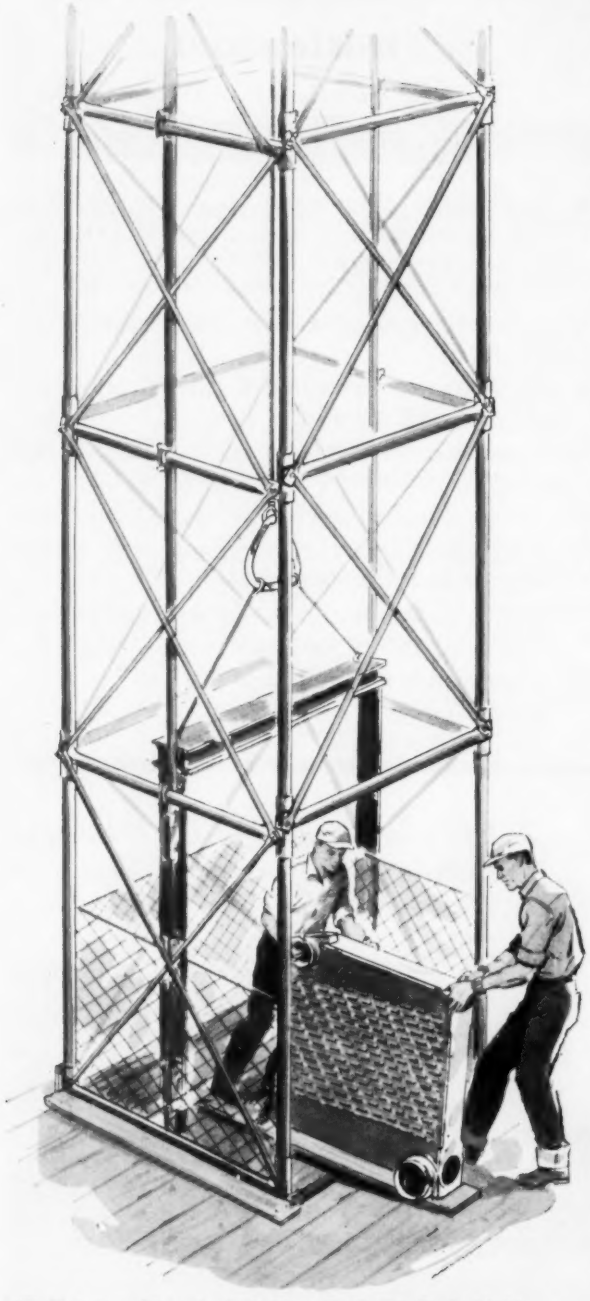
Remember . . . only Sporlan Catch-All Filter-Driers give you Really Clean, Dry, Acid-Free Refrigerant Systems!



HOW TO INSTALL A BOILER IN A PENTHOUSE... *WITHOUT A DERRICK!*



It's no trick at all with a Weil-McLain cast iron sectional boiler—either gas or oil fired. In penthouse installations, the sections can be brought up in the personnel hoist...no need to rig a derrick.

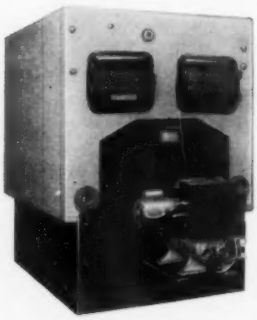
Both in new construction and in replacement work, the sectional construction of Weil-McLain Boilers is a distinct and valuable feature. The work on a new building need not be held up waiting for the arrival of the boiler...nor must the boiler be installed before the building is completed, subjecting it to weather, construction damage or vandalism.

If a boiler is to be completely replaced, a Weil-McLain cast iron boiler can be moved in through an ordinary door, section by section. If additional capacity is required, a second boiler can be installed to supplement the original boiler. Or, additional sections can be added to the present boiler. Weil-McLain Boilers are assembled with short draw rods, a feature which simplifies erection and assures freedom from stresses and strains.

For detailed information on Weil-McLain Oil Boilers, see Engineers' Product File or Sweet's Architectural File. For current Gas Boiler data, send for Bulletin C-297.

WEIL-McLAIN BOILERS FOR COMMERCIAL AND INDUSTRIAL HEATING SYSTEMS

FOR GAS
Capacities to
3,354,000 BTU/hr.



FOR OIL
Capacities to
2,942,500 BTU/hr.

WEIL-McLAIN
CAST IRON BOILERS

Address literature requests to Dept. AA-70

WEIL-McLAIN COMPANY • MICHIGAN CITY, INDIANA

THE NEW, TIGHT-CLOSING PRESSURE REDUCING VALVE THAT *CAN'T FOUL*

If you like a simple, straight-forward solution to vexing valve problems, you're bound to be impressed with the new line of Leslie-Topper Pressure Reducing Valves. To avoid valve fouling, Leslie Engineers developed a tight-closing valve with an internal pilot that's completely out of the path of steam—*it just can't foul.* Let imaginative engineering simplify valve design and you get results.

Here's the one pressure reducing valve that handles poor steam conditions, intermittent or standby service better than any other valve. It provides high accuracy of regulation with negligible dead-end build up and costs only pennies for maintenance.

New, patented Leslie-Spiroflex* all metal diaphragm insures years of outstanding valve performance. It makes a long valve stroke possible in a packless design—there's nothing to leak, nothing to bind. It's time for a change when you can get rid of the cost and bother of fussy, old-fashioned pressure regulators.

*Trademark of Leslie Co.

Leslie-Topper Selection Table

Size	Inlet Pressure PSI	Adjustable Pressure Range PSI	CLASS		
			Cast Iron Construction	Bronze Body Construction With Iron Superstructure Castings*	All Bronze Construction
½" TO 1¼"	UP TO 150	2 - 10	GKLL	GLL	GBLL
	OVER 125	2 - 10	GKL	GL	GBL
	UP TO MAXIMUM BODY RATING	5 - 20	GKM	GM	GBM
		15 - 35	GKH	GH	GBH
1½" TO 2"		2 - 10	GKL	GL	GBL
		5 - 20	GKM	GM	GBM
	UP TO 150	5 - 35	GKHL	GHL	GBHL

*All parts in contact with controlled fluid are of bronze.

For sizing and capacity data write for Bulletin 582 or contact your Leslie Engineer—he's listed in the Yellow Pages under 'Valves' or 'Regulators'.

Leslie Co., 703B Grant Ave., Lyndhurst, New Jersey

This new Leslie-Topper Pressure Reducing valve is a part of Leslie's expanding line of control valves, regulators and pilots for steam, air and liquids.

TRADE LESLIE MARK

REGULATORS and CONTROLLERS

AMMONODUCT STEEL PIPE

for Championship Refrigeration

Architect:
Corlett and Spackman, A.I.A., and Kitchen and Hunt, A.I.A.
Mechanical & Electrical Engineers:
Vandament and Darmsted
Mechanical Contractor:
Gay Engineering Corp.
Pipe Jobber:
Monarch Piping and Engineering

Here, inside the magnificent Olympic Arena at Squaw Valley, 9,000 spectators thrilled to championship figure-skating and ice-hockey events at the 1960 Winter Olympics. And under the surface of the 85 x 190-ft rink Bethlehem steel pipe performed flawlessly, just as it will continue to do for years to come.

Nearly 11 miles of 1¼-in. Ammonoduct steel refrigeration pipe help create and support ice on the rink to a thickness of about one inch. Welded into 196-ft lengths and installed on 3½-in. centers, the pipe was connected to the 8-in. headers and 16-in. distribution mains (Bethlehem electric resistance-weld steel pipe), and embedded in a 5-in. concrete slab. The entire system was tested out at 150 psi.

Here's why steel pipe is specified by engineers as first choice for ice-rink installations: it can be fabricated cold without fracture, it is available in double-random lengths, and it costs considerably less than any other ferrous piping material. And because Ammonoduct provides top service for 20 years and longer, it's a favorite with contractors and builders as well.

Check today with your pipe distributor. Or call the nearest Bethlehem sales office.

Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

For Your Protection

SPECIFY • INSTALL

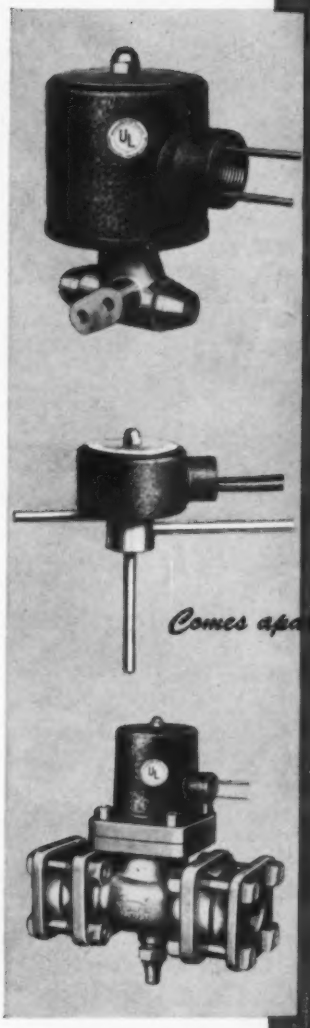
ALCO
SOLENOID VALVES

FOR POSITIVE CONTROL

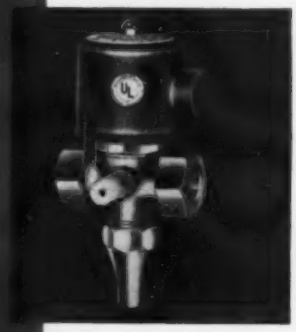
ALCO'S HIGH QUALITY

Guarantees Maximum Life

- Constructed both for hermetic and non-hermetic applications
- Manufactured of the best grades of corrosion-resistant materials
- Alco's Cool, POWER-PACKED coils, moisture proof impregnated
- Positive closing with pressure tested seating for POSITIVE SHUT-OFF
- All MANUFACTURED by ALCO to ALCO's high Quality Control Standards



Comes apart easily in the line for cleaning



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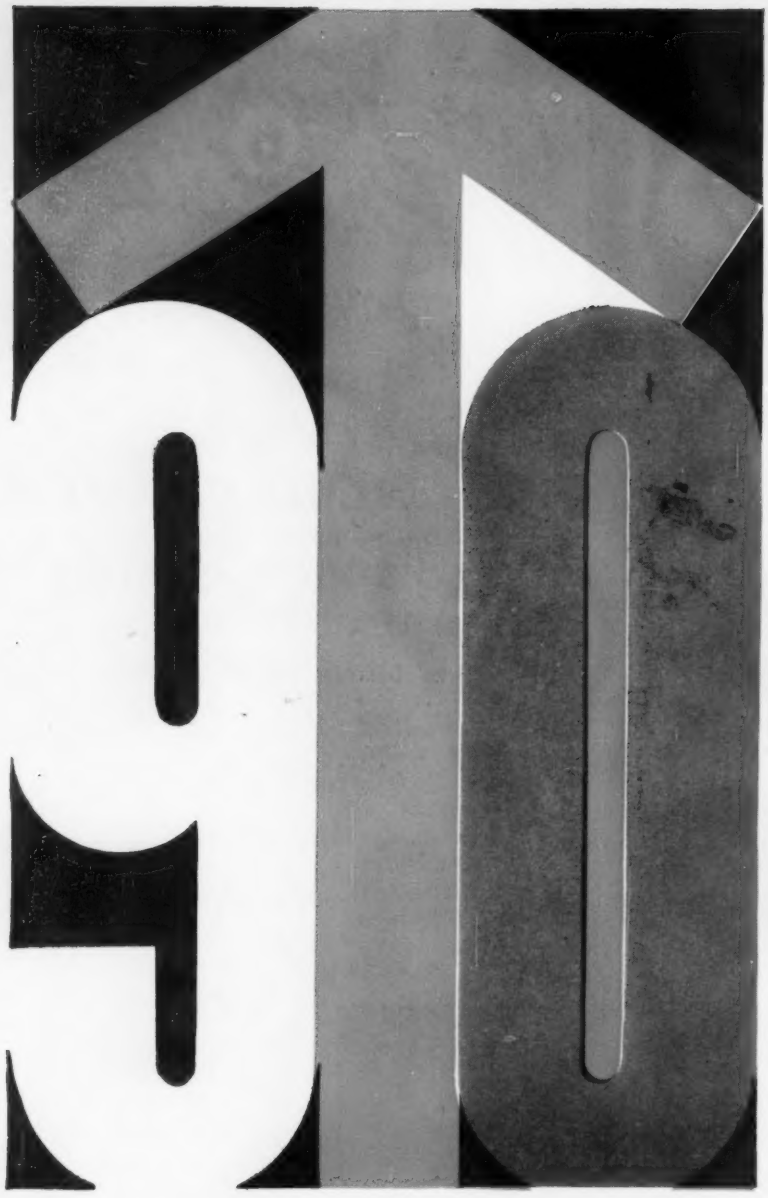

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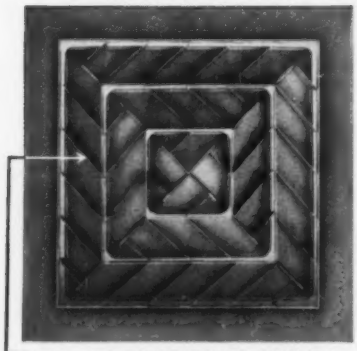
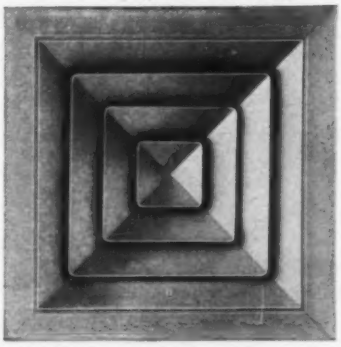
WITH BUILT-IN DIFFUSING VANES CONTROL EVERY CUBIC FOOT OF AIR IN ANY ENCLOSURE

AGITAIR Diffuser



These AGITAIR DIFFUSING VANES provide 64 active air jets to every square foot of the diffuser.

Most Copied Design



AGITAIR originated square and rectangular designed diffusers.

AGITAIR unequaled performance efficiency ...job-proven more than 1,000,000 times

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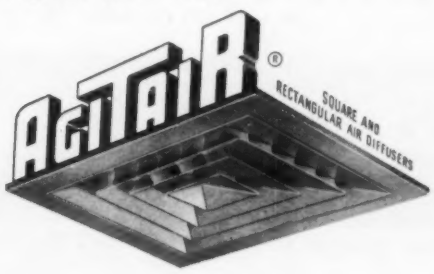
Today, more than 1,000,000 AGITAIR custom-made square and rectangular diffusers are installed on thousands of applications in all kinds of business.

AGITAIR diffusers provide 100% draftless air distribution from any location in the ceiling or sidewall with blows in 1, 2, 3 or 4 directions and with no stagnant areas in the conditioned spaces. No blank offs.



The vane and louvre construction of AGITAIR square and rectangular air diffusers produces counter-flowing air streams or jets (64 to a square foot). This action induces movement of all room air toward the diffuser while rapidly mixing the conditioned air with room air to assure instantaneous temperature equalization and draftless distribution. Plaques are incapable of performing these basic functions.

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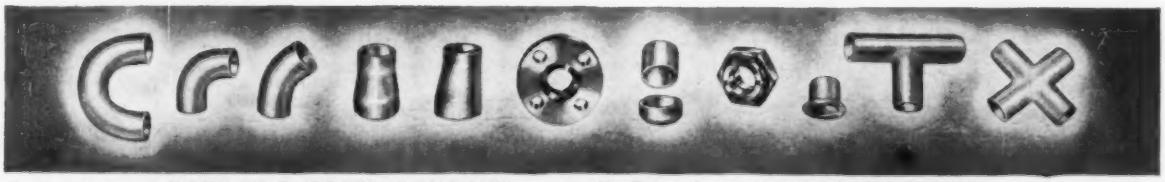

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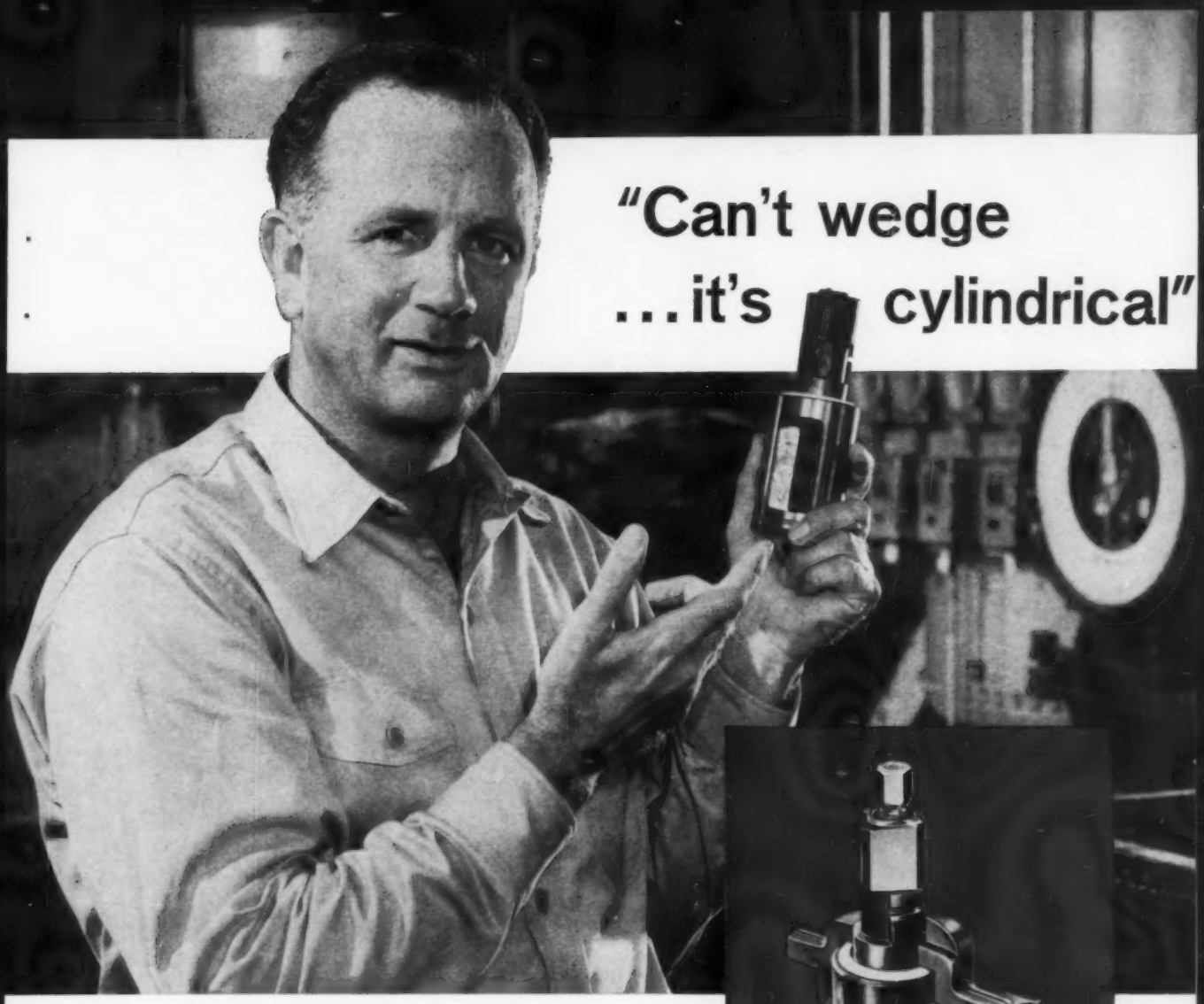

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Sizes: ½" through 30".

Working Pressures: 125 through 800 pounds.

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5910-R

USE "K&M" ASBESTOS-CEMENT AIR DUCT for heating, air conditioning and ventilating slab buildings...permanent, non-corrosive

Used for perimeter-loop, radial, and lateral air systems, "K&M" Asbestos-Cement Air Duct can be laid directly on the moisture barrier, resting on it and the prepared bottom. Since there is no concrete encasement to cause it to float, it needs no anchoring. You never have to worry about costly pipe replacement and floor repairs due to unobserved floating.

"K&M" Air Duct won't weaken or crack under normal super-imposed loads. Never corrodes or deteriorates. It's strong and lightweight, almost as permanent as stone. Its smooth interior bore stays clear year in and year out, assuring even, unimpeded air flow. It has no odor.

"K&M" Air Duct is fast, easy, and economical to install in residential, commercial, institutional, and industrial buildings. The light 13-foot lengths require fewer joints. And these joints are quickly and securely sealed with "K&M" Air Duct tape prior to pouring the slab. What's more, "K&M" Air Duct can be cut to fit on the job to prevent wasteful short lengths and leftovers. Also, stack head take-offs for registers or diffusers are easily cut with a chisel or carborundum disk. "K&M" Air Duct can be stored outside, on the job, without weather or dampness damage, and can be walked on during installation without damage.

Write today for a comprehensive illustrated brochure outlining in more detail the uses and advantages of "K&M" Asbestos-Cement Air Duct. Keasbey & Mattison Company, Ambler, Pa. Dept. P-2470.

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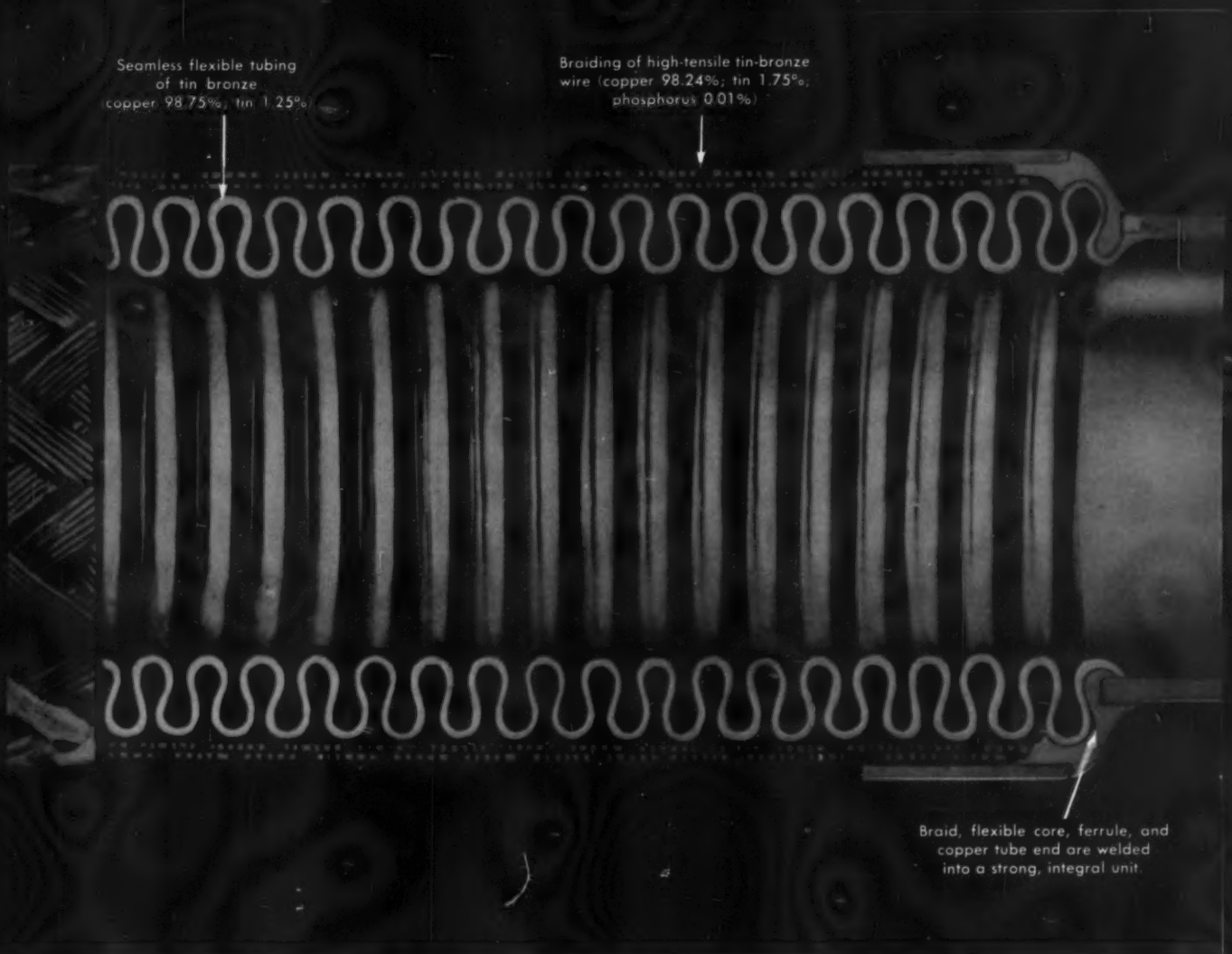
Seamless flexible tubing of tin bronze copper 98.75%, tin 1.25%
Braiding of high-tensile tin-bronze wire (copper 98.24%; tin 1.75%; phosphorus 0.01%)
Braid, flexible core, ferrule, and copper tube end are welded into a strong, integral unit.

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Anaconda Vibration Eliminators, identified on the ferrule, are listed under Reexamination Service of Underwriters' Laboratories, Inc.

59151

ANACONDA®
VIBRATION ELIMINATORS

Low Water Cut-offs on Hot Water Boilers?!

...the industry has given the answer

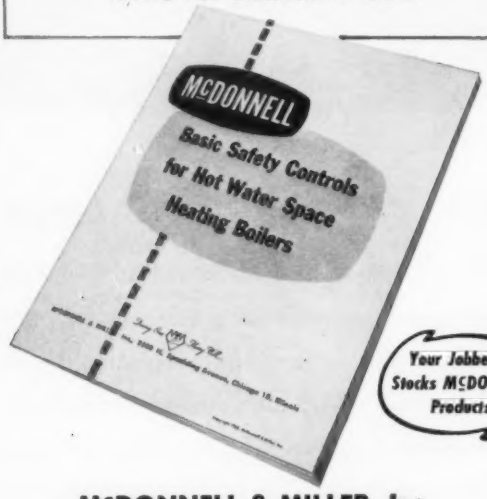
Yes, the answer has come from the field . . . from the engineers, contractors and manufacturers. They have seen the logic of installing a water level control on hot water space heating boilers . . . a low water cut-off, or—for even greater precaution—a feeder cut-off combination.

We knew it was a good idea. Expected it to grow and grow. But frankly we have been surprised at how rapidly the heating industry has taken hold of water level control as a logical team mate for an ASME pressure relief valve.

In fact, many local codes now require a low water cut-off, or feeder cut-off combination, on hot water boilers installed in places of public occupancy—including multiple dwelling units.

Notice the diagrams of recommended installations opposite. For more detailed discussion get this booklet that tells the whole story: "Basic Safety Controls for Hot Water Space Heating Boilers."

The What-Why-How in eight interesting pages
Write for Bulletin P-30C



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Doing One Thing Well

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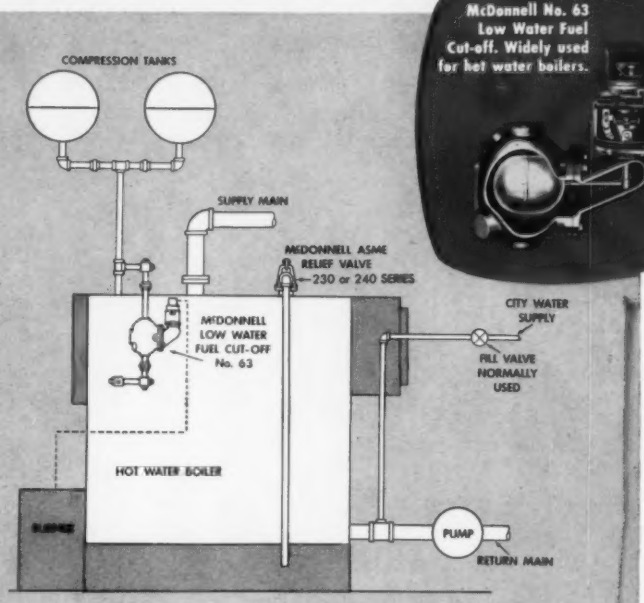
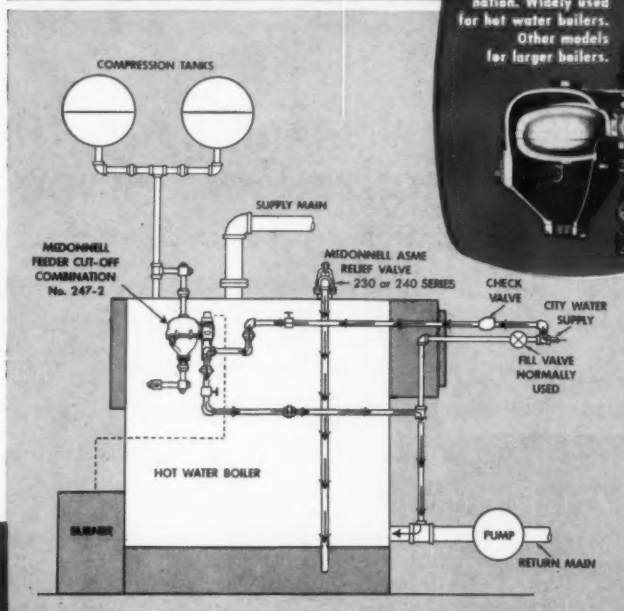
Boiler Water Level Controls

McDonnell No. 63 Low Water Fuel Cut-off. Widely used for hot water boilers.



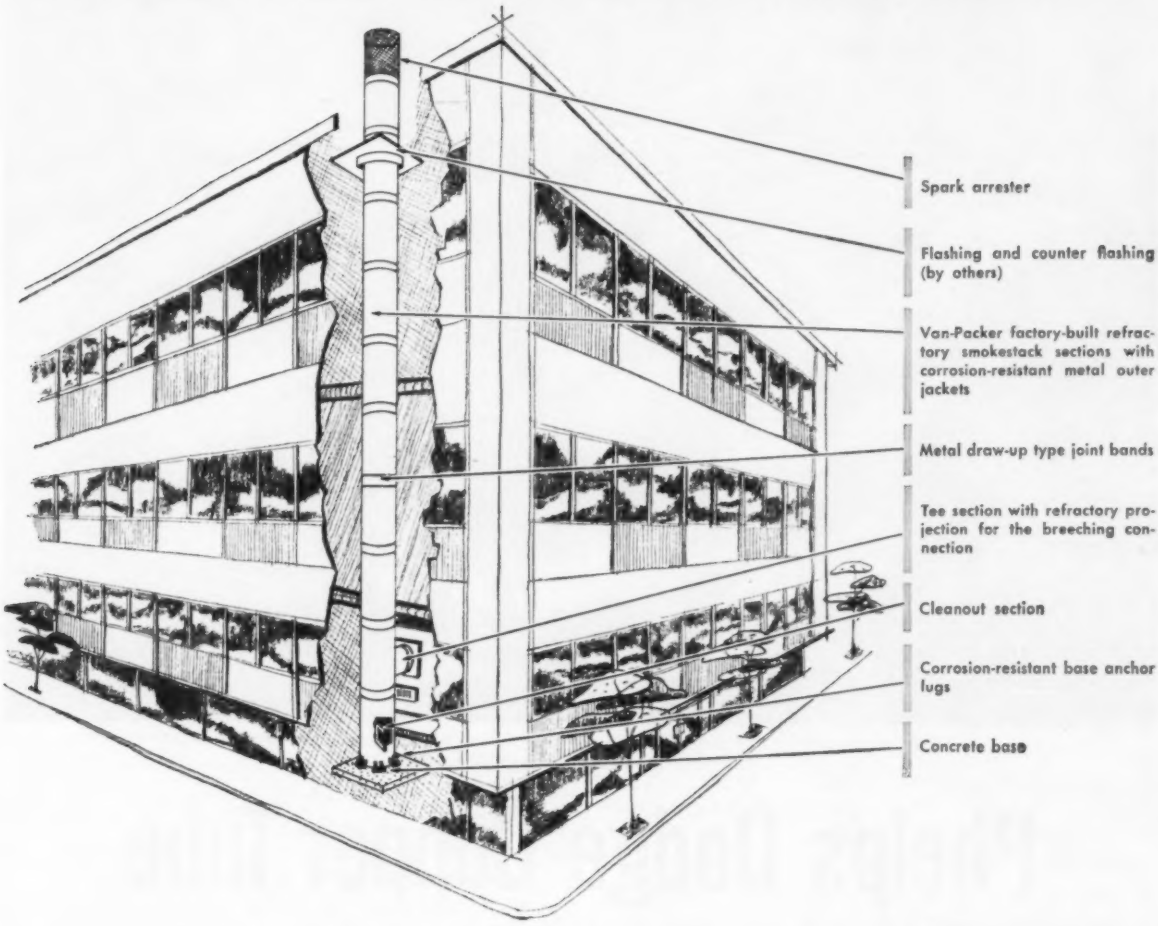
1 The essential low water control for a hot water boiler. A McDonnell Low Water Cut-off located above lowest permissable water level; also McDonnell A.S.M.E. Pressure Relief Valve.

McDonnell No. 247-2 Feeder Cut-off Combination. Widely used for hot water boilers. Other models for larger boilers.



2 The safest and most complete control for a hot water boiler. Offers a combination of mechanical and electrical safeguards which is today's best and most complete answer. A McDonnell combination Boiler Water Feeder and Low Water Cut-off; also McDonnell A.S.M.E. Pressure Relief Valve.

Flintkote • Van-Packer factory-built refractory smokestack simplifies stack location problems


Spark arrester
Flashing and counter flashing (by others)
Van-Packer factory-built refractory smokestack sections with corrosion-resistant metal outer jackets
Metal draw-up type joint bands
Tee section with refractory projection for the breeching connection
Cleanout section
Corrosion-resistant base anchor lugs
Concrete base

Van-Packer smokestacks are 3-foot modular, factory-built refractory sections encased in a corrosion-resistant metal outer jacket. They require no painting or routine maintenance, which means your architectural designs can be made with minimum provision for smokestack accessibility. In many cases, this simplifies design requirements and makes possible greater flexibility, and more pleasing architectural effects.

Van-Packer Model HT Smokestacks are the *only* smokestacks listed under the Factory Inspection and Label Service Program of Underwriters' Laboratories, Inc., for use with boilers and incinerators. Available in 10", 12", 15", 18", 21", 24", 30", and 36" inner diameters. Mail coupon for full information.

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Please send Bulletin IS-40 containing complete information and engineering data on Van-Packer Smokestacks.

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Completion of building is scheduled for 1961.

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Within the superb new Hall of Justice being constructed for the City and County of San Francisco will be over a quarter million pounds of Phelps Dodge copper water and DWV tube serving as plumbing lines for this completely modern structure.

The new Hall of Justice will bring together under one roof all the functions of the city and county related to law enforcement. Among the novel features will be a heliport located on the roof.

General contractors for the project are the M & K Construction Corporation, while J. B. Nettles & Co., Inc. is the mechanical contractor and G-M-Simonson, the electrical and mechanical engineers. Project architects under the direction of Bureau of Architecture, Department of Public Works, are Weihe, Frock & Kruse, together with the City Architect, Charles W. Griffith. The plumbing distributor is P. E. O'Hair and Co. of San Francisco.

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From the Golden Gate to Gotham, plumbing contractors know they can rely on the quality of Phelps Dodge famous "Mine-to-Market" tube and pipe. That's why so many of them specify Phelps Dodge for every kind of installation!

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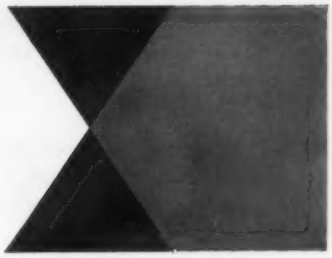
We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.



"Open for Discussion"

HTHW System Designer Must Check Temperature-Pressure Relationship

WE HAVE READ the HPAC Engineering Data File, *How to Select and Control High Temperature Hot Water End-Use Heat Exchangers* (June), with a great deal of interest and feel that it offers a lot of concrete information that is sorely needed in this field. We congratulate you on your discussion of high temperature hot water heating.

You may be interested in a problem we encountered on an installation. The system utilized 420 F water as a heating medium through the tubes in a shell-and-tube exchanger, with water for a radiation system through the shell being raised from 190 to 210 F. The pump on the low temperature water was on the *outlet* side, approximately 6 ft from the exchanger. Terrific banging and hammering was apparent in both the pump and the exchanger. After three months' operation, it was necessary for us to replace the tube bundle in the exchanger. On studying the situation, we found that, as a result of the drop through the system and the location of the pump, the low temperature water in the exchanger was turning to steam because of the pressure-temperature relationship. By simply placing the pump on the *inlet* side of the exchanger, the situation was corrected.

The point we are emphasizing is that the designer must at all times consider his temperature-pressure relationship so that steaming does not occur.

H. M. KELLEY
Sales Manager
Ellicott Fabricators, Inc.

"Or Equal" Means Good Representative, Too

WHAT DOES an engineer mean by the term "or equal" which is so often found in his specifications? Does he mean equality as to capacity, materials of construction, operating efficiency, noise level, safety, and general suitability to the overall system design? Obviously, he means all these things. Not so obviously, he means, or should mean, much more than this.

Equality from the engineer's standpoint should include the competence and integrity of the manufacturers' representative who sells the equipment — his degree of usefulness, both in the design stage and after the installation is complete — his conscientiousness in furnishing the item in strict accord with the engineer's intention.

From the client's point of view, another factor determining equality is ease and frequency of maintenance. This can be built in by the manufacturer and evaluated by the engineer. It can be enhanced by standardization, as in the case of a school district using a large number of pumps, traps, burners, etc.

Undoubtedly the engineer has all these things in mind when he says "or equal." But later on, engaged in the time-consuming and costly phase of his job wherein he must approve or reject substitutes, he finds it difficult to apply some of them in his evaluations. The sheaf of drawings and catalog bulletins in front of him reveal only the obvious factors of equality. The other factors are harder for him to put his finger on. Some of them are in his head. They are there as the result of his judgment and experience. Since judgment and experience are among the qualifications which make a professional man worthy of his fee, he is expected to exercise them. And if he does exercise them, he will have to reject certain items for reasons that are not entirely obvious to other interested parties.

One of these reasons could be that he has not yet been convinced of the manufacturers' representative's competence, integrity, usefulness to himself and his client, or his conscientiousness. If this reason

"Open for Discussion"

Continued

seems irrelevant and unimportant, just imagine what the situation would be if all representatives were incompetent, dishonest, unavailable when needed, or careless. Happily, such is not the case, since most of the men engaged in this work are rather carefully selected by reputable manufacturers.

There is always the possibility, however, that a representative who is deficient in the eyes of a given engineer will attempt to force acceptance of his product by cutting his price below that of his specified competitor. The value of a representative must be based on something more than handing out catalogs and quoting the lowest price.

Unless the engineer takes this into consideration in determining "equals," he will find the service rendered by the representative gradually deteriorating. The latter, finding that he cannot earn a fair price for his services in a field where the low dollar always gets the business, either turns to something better or decides to stay and make the best of it. The "best" turns out to be much less than that, for he finds himself nagging his manufacturers for a more competitive pricing structure, and the manufacturer will heed this demand by producing to a price standard rather than to a quality standard. As quality declines, his problem is multiplied, as are the problems of the engineer, the contractor, and the owner.

R. F. Donovan
Manufacturers' Representative

"Reverse Air Flow System" Removes ERMA Check-Reader Heat Output

In my previous article, *Unique Built-Up System Serves Exacting Temperature, Humidity Demands of Finicky Electronic Computers* (February 1959), concerning the Bank of America's Los Angeles central data processing building, reference was made to future electronic equipment to be installed at a later date.

This equipment is capable of "reading" code numbers printed on bank checks in magnetic ink. When finally constructed, this equipment, known as ERMA, turned out to have greater heat output than the original assumption by the equipment design engineer.

In order to handle this additional quantity of heat by conventional methods of air conditioning, it would have been necessary to introduce air to the space in quantities approaching 120 air changes per hour.

A new concept of computer room air conditioning was advanced by this author and accepted by the electronics engineers employed by the manufacturer of the equipment which would permit decreasing the amount of air by increasing the temperature change in the following manner. Air is introduced to the space at approximately 55 F dry bulb in quantities adequate to absorb the building load, lighting load, and the occupants. It is then exhausted through the ERMA machines in order to absorb their inherent heat dissipation after the air leaves the room. Furnishing hoods for the equipment was not considered practical, but reversing the flow downward through the machines seemed practical and accomplished similar results. The usual internal circulating air fan, which is furnished as part of such electronic equipment, was not installed. This concept was called the "reverse air flow system."

Air supply in this computer room is delivered through a ceiling plenum and exhausted through a floor plenum. This made the installation easier since no ducts would be required.

The circuit of the conditioned air in the "reverse air flow system" is as follows:

1) Outside air and return air in varying portions are electrostatically filtered by high velocity dry type filters.

2) Then the air enters a spray coil unit for humidification or dehumidification to a fixed dewpoint at approximately 53 F. It is reheated by mixing, if required.

3) From there it goes to the computer room via the ceiling plenum and ceiling diffusers. This room is maintained at 74 F and 50 percent relative humidity.

4) Room air is exhausted out through the ERMA machine into the floor plenum in quantities required by the ERMA machines to remove their heat. The excess quantity, if any, is exhausted to the floor plenum by baseboard grilles. This return air temperature is now computed to be 85 F.

5) The return air at 85 F can be exhausted or recirculated, but at an entirely different schedule from the return air at the usual 74 F with apparent operating economies.

The difference in temperature of $85 - 53 = 32$ F spread compared with $74 - 53 = 21$ F spread of the conventional computer design indicates the advantages of the "reversed air flow" of approximately 40 percent reduction in air quantity. The 85 F return air contains sufficient heat for the humidification of the air at all times in all seasons.

Air balance is maintained by the installation of a perforated plate damper in the base of the ERMA machine where the circulating fan was to have been installed. In addition to the reduction in air quantity, this new concept of design eliminated 33 hp of small circulating fans in the computer units.

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Hinkston and Norcross, Inc.
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ALL spray water is contained within a COPPER WATER JACKET. This exclusive DOUBLE WALL CONSTRUCTION assures product longevity and lower maintenance. In fact, throughout the entire unit, you find QUALITY . . . with no worry about faulty galvanizing or temporary corrosion protection.

You also have an extremely WIDE SELECTION, as this evaporative condenser is supplied for REMOTE installation or as an integral part of Governair Corporation's self-contained PACKAGED equipment . . . Conventional; Multi-Zone (as pictured); and Water Chillers.

GOVERNAIR

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"Open for Discussion"

Continued

Orifice Sizing Method Is Valuable Contribution to Design Engineers

THE ARTICLE, *How to Size and Locate Orifices for Measuring Flow in Piping*, by John P. Johnston (April), is valuable to the design engineer in that data is provided in relatively simple form so the engineer does not have to search for references. Mr. Johnston has made available a reliable and most practical system of sizing orifices for liquid flow measurement and/or designing pressure loss into a flow system.

In our experimental laboratory we have used orifices for rather precise measurement of air flow. The methods used are quite similar to those proposed by Mr. Johnston, i.e., calculation of Reynolds Number and selecting the orifice coefficient from the literature. Incidentally, compressibility factors are available for calculation and measurement of flow of gases with orifices. Therefore, one more table or graph added to the figures which Mr. Johnston has plotted would extend the application range of his data.

Occasionally, temperature variations of the fluid flowing can cause a significant change in orifice area. However, in the range of temperatures which the author intends to apply his data, this correction would be insignificant. Factors are available in the literature, should temperature variations become extreme.

The examples worked out by the author have been checked by calculation using design data as reported in *Flow Measurement*, 1940, published by the American Society of Mechanical Engineers. Reasonably good agreement was obtained. It was necessary to extrapolate the d/D ratio in some cases so that exact selection of the orifice coefficient was not possible.

E. L. SARTAIN
Laboratory Head
Experimental Heating Laboratory
Modine Mfg. Co.

Bottle-Neck Is Not in the Fins; It's in the Surface Films Instead

I NOTED with interest Lester T. Avery's article, *Too Many Fins Can Bottle-Neck Heat Transfer* (February). I hate to tangle with such a distinguished engineer as Mr. Avery, but from considerable experience in the production of thousands of units, I have to point out that we cannot confirm his conclusions.

It is quite true that all heat removed from the product must pass through the prime surface of the tube. Even more significant, however, is the fact that it must also pass the refrigerant film at the inside boundary of the tube and the air film at the surface of the fins.

The ratio of the air film coefficient to the refrigerant coefficient is of the order of 1 to 20. Using all prime surface or even a secondary to primary ratio of 5 to 10 to 1 is simply a waste of material. Calculations show that, at 13 fins per in., the effectiveness of the metal in the fin is about 90 percent of that of prime surface. The bottle-neck is not in the fins, but in the surface films.

Dirt on fins has simply not been a problem. There are thousands of air cooled condensers in applications all over the country with at least five years' operation that show no appreciable change due to dirt. This is also true of room air conditioners — some of which have been in operation 10 years.

The only real problem in close fin spacing occurs in evaporator coils where lint may collect as a mat on the fin surface and thereafter act as a filter to collect dirt and block air flow. This is the reason it is necessary to use filters with evaporator coils. However, it is never wise to use evaporators without some sort of filtering, since lint can block air flow, even in a five or six fin per in. coil.

PAUL W. WYCKOFF
Chief Engineer and Director of Product
Chrysler Airtemp Div.
Chrysler Corp.

Trend Is Toward Eddy Current Testing for Stainless Pipe Flaws

WE HAVE read *Why Stainless Steel Is Used for Process Piping*, by Arthur C. Wicker (April and May), and feel it is an excellent article and covers the subject thoroughly.

Our only comment is in regard to the section on testing for surface defects. In the welded stainless tubing and pipe industry, there is the growing trend toward the use of eddy current testing for the detection of surface and subsurface flaws as a direct substitute for hydrostatic testing. More and more users are beginning to recognize the inadequacy of the hydrostatic test and are asking for something that will give measurable results. It would appear that the eddy current test is a satisfactory one. We are commercially testing stainless tubing and pipe to the following standards:

Farrowtest Reject Table

Wall thickness (B.W. gage)	Minor dimension of the defect (length or depth)	Defective area (lengths, depth plane), sq. in.
20	0.006 in.	0.0025
18	0.006 in.	0.003
16	12½% of wall	0.003
14 and 13	12½% of wall	0.004
12 and heavier	12½% of wall	0.005

Farrowtest detects and rejects not only tubing containing defects which completely penetrate the wall, but also tubing with defects equal to or greater than

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ADSCO STORAGE WATER HEATERS
have removable heating elements. Many materials available for tank construction, including solid or clad corrosion-resistant metals. Linings include ADSCO Phenolic No. 6-2, ADSCOTE, or galvanizing. Bulletin 54-75.

ADSCO INSTANTANEOUS WATER HEATERS AND CONVERTORS
are furnished in either steam-tube or water-tube type. Design is simple U-bend with removable element. Convertor Bulletin No. 54-77; Instantaneous Bulletin No. 54-78.

An abundance of hot water flows continuously from dependable ADSCO Heaters... for use in washrooms, space heating, or processing. ADSCO Heaters are engineered for maximum heat exchange efficiency, built out of quality materials by workmen whose legacy of experience dates back to the year 1877. Best of all, ADSCO Heaters are manufactured from numerous *standard designs*. This keeps costs down while still providing a wide choice of capacities... Write for bulletins.

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Sold, Engineered and Manufactured by
YUBA HEAT TRANSFER DIVISION
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World's Oldest and Largest Manufacturer of Packed and Packless Expansion Joints

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heating
air-conditioning
consumer durable

"Open for Discussion"

Continued

those shown in this table. For irregular defect shapes, a tube with defect area equal to or greater than given in the table is rejectable. Where required, sensitivity of Farrowtest equipment can be calibrated to reject defects of lesser specified area than shown in the table, at extra cost.

Again, we think that this article is a worthwhile contribution.

W. J. Resiner
Manager of Sales
Stainless Div.
Steel and Tubes Div.
Republic Steel Corp.

The author's reply — Mr. Resiner's interest in this article is appreciated and his comments concerning eddy current testing are well taken.

My company is predominately concerned with the testing of butt welding fittings and flanges and, for the sake of brevity, mention was made of only the two routine dye penetrant tests used in the production of stainless steel fittings and flanges. We did not mean to infer that there are not other excellent testing methods being used by other companies on tubes and pipes rather than fittings.

Actually, our testing facilities run the full gamut of X-ray, magnetic particle, ultrasonic, radiography, etc. These methods are used based on an individual analysis of the item in question. Each test has its most advantageous applications, both metallurgically and economically speaking, and it requires a well-qualified quality control staff to select and interpret the proper test.

We mentioned the dye penetrant tests mainly because they reveal surface defects that can be interpreted by relatively untrained personnel. We would classify eddy current testing as a nondestructive method of testing for subsurface flaws, falling in the same category as X-ray, magentic particle, and ultrasonic testing. Each of these requires a highly trained and experienced technician to interpret the magnitude of a flaw.

We have no practical experience with eddy current testing since we do not manufacture pipe and tubing; our knowledge to date has been obtained from the available literature on this subject. We would be most interested in any comments regarding the possibility of using eddy current testing on the irregular shapes of fittings and flanges over our wide range of sizes, thicknesses, and alloys.

Arthur C. Wicker
Alloy Specialist
Tube Turns Div.
Chemetron Corp.

READER ASKS—

"How Much Load From Vapor Infiltration?"

"My problem is primarily concerned with moisture vapor infiltration and/or transmission through cracks and door openings. Our operations include research with hazardous, explosive materials and must be conducted in an atmosphere of low moisture content (about 20 grains per lb of dry air). Due to their character, these materials must be isolated in small cells having one light or frangible wall and roof for explosion relief.

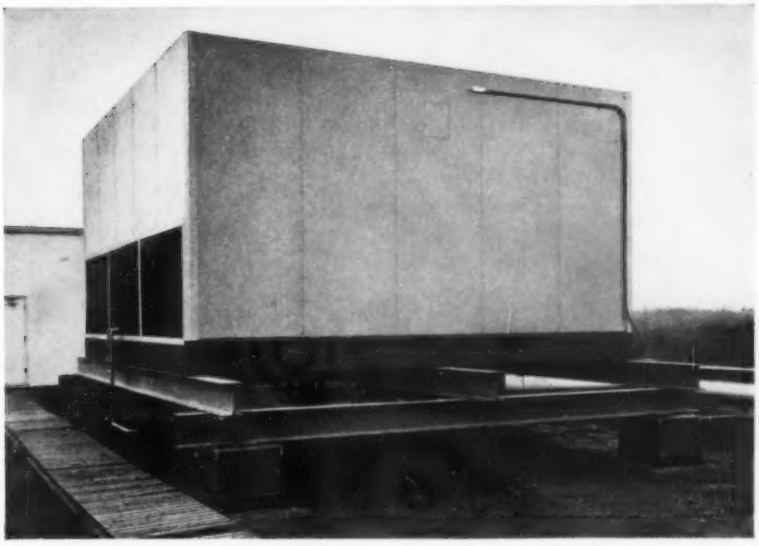
"Recirculation is prohibited, due to the same hazards. Therefore it is desirable to keep the number of air changes to a minimum for the sake of economy. Exhaust fans and hoods are utilized which remove approximately 90 percent of the supply air. The doors, which are the only means of access, are located in the relief wall and constitute about 16 percent of the perimeter of the cell walls.

"My question is in two parts: (1) How much latent and sensible load should be included per ft of crack and per door opening with outside design of 100 F dry bulb, 81 F wet bulb, and with 15 mph wind? (2) Can the water vapor infiltration through the cracks be prevented by a positive air pressure within the space?

"It seems entirely possible, with the nearly 10 in. of water gage difference in vapor pressure between the outside and inside, that water vapor might be coming in while air could be traveling in the same direction along the same path.

"I would also appreciate knowing of any good reference material concerning the above problem, as well as the fundamentals and behavior of the mixing of gases, partial pressures, and vapor pressures."—M.B.M.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*



NEW FROM CARRIER... FIRST MAJOR COOLING TOWER ADVANCE IN YEARS!

Lower operating weights—as much as 50% and more over conventional cooling towers.

Requires less floor space—about 25% less over-all base or floor area than other towers of same capacity.

More efficient and compact—with heat transfer efficiency maintained at a continuously high level and compactness that provides more freedom of tower site location.

The new Carrier all-steel Cooling Towers combine substantial savings in weight and floor space with a new standard of efficiency in operation. These important advantages are achieved by advanced Carrier design and the use of a new kind of lightweight, plastic fortified cellulose fill, which occupies just 1/5 the space of conventional wooden strips. Tested under the most severe conditions, this fill has stood up structurally and performance-wise.

Carrier Cooling Towers are now in use throughout the United States. They are available in 9 sizes with capacity range from 170 to 500 tons in a single cell. Larger tonnages can be handled with multiple cell towers. Besides savings in weight and space, they also offer lower installation costs and operating advantages. For details, write Machinery and Systems Division, Carrier Corporation, Syracuse 1, New York.

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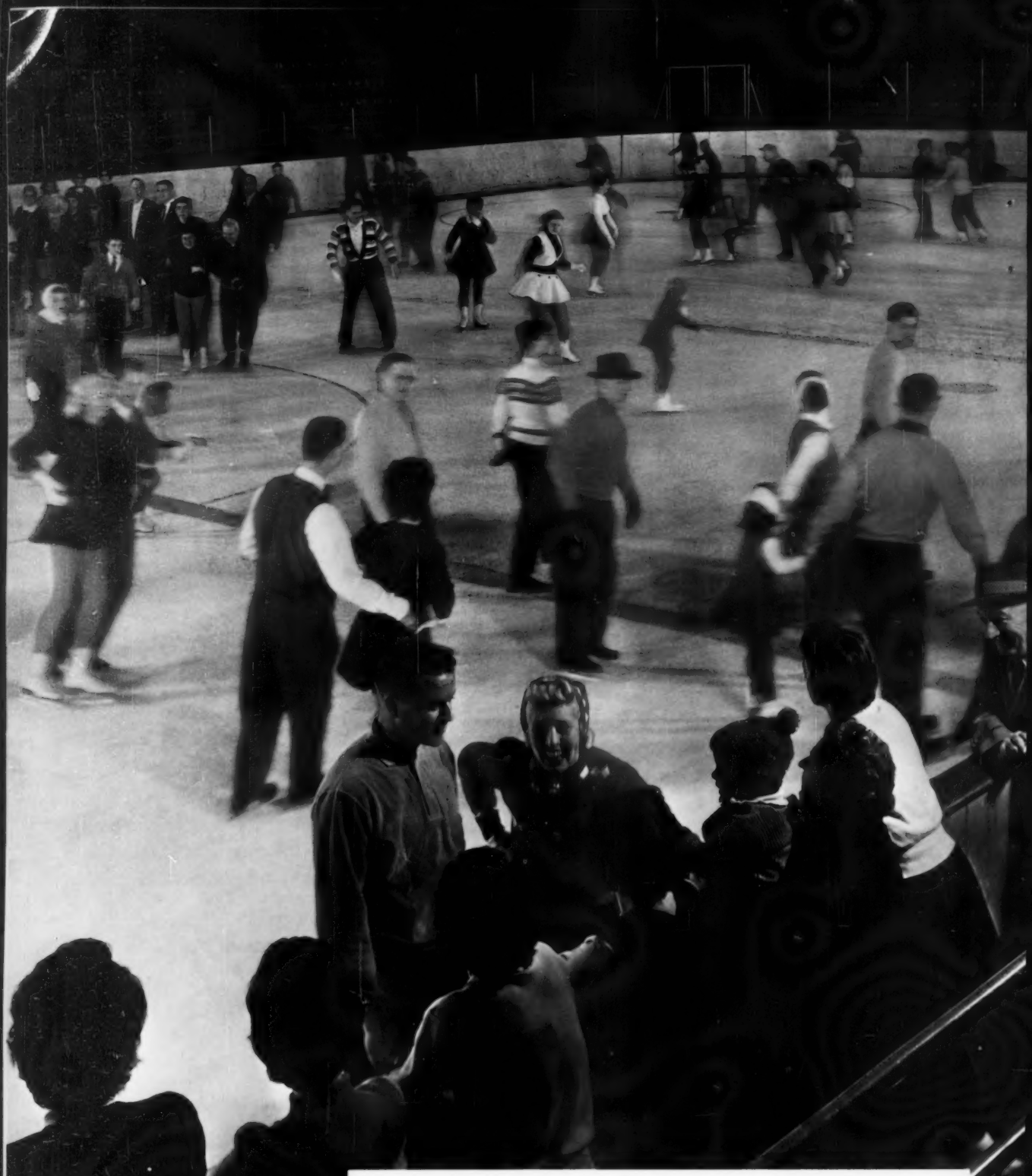
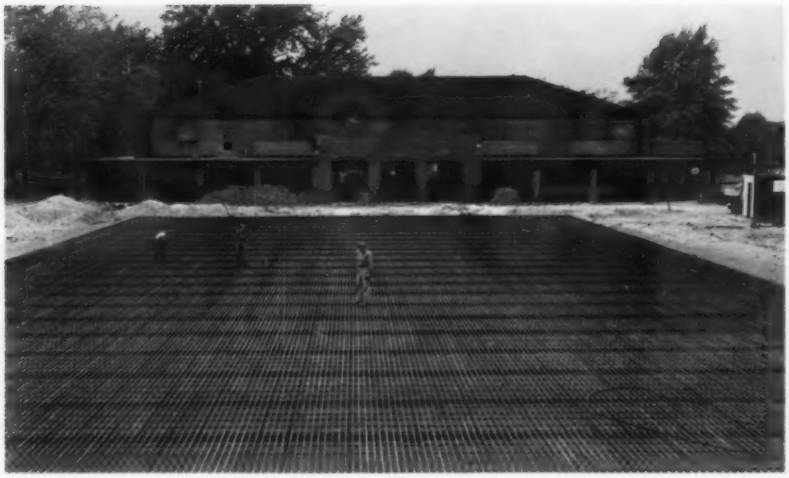


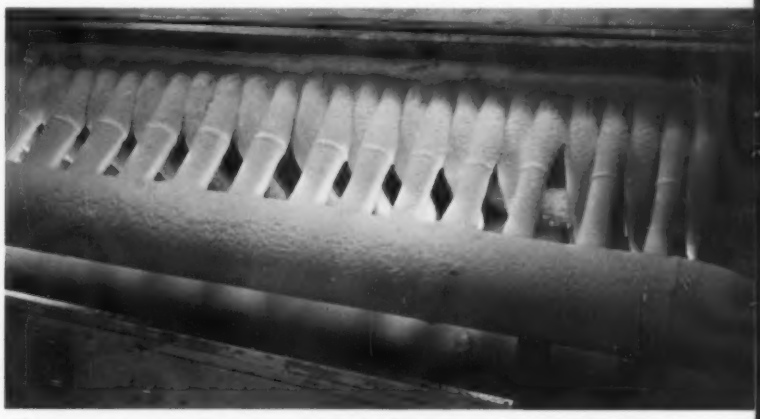
COMMUNITY ICE ESCAPADES are increasing in popularity with modern indoor rinks such as this one in Lewiston, Maine. This 85 x 200-foot Central Maine Youth Center Rink was built for the Order of Dominican Fathers with the aid of funds contributed by friends. Local skating clubs and hockey leagues—and novices, too—are enthusiastic about having this opportunity for rink recreation. And under that ice is a network of more than 10½ miles of 1¼-inch Jal-Con-Weld steel pipe.



New skating facilities have been added recently in two of Cleveland's public parks. Both rinks have utilized 1-inch J&L Jal-Con-Weld pipe. Architect—Damon, Worely, Samuels & Assoc. Contractor—Smylie Bros., Inc. Distributor—Clark Goodman Supply Co., Inc.

The Woodland Hills Park installation required over 9½ miles of pipe and 2,000 welds.

J&L STEEL



This cross trench shows arrangement of supply and return headers for the Central Maine Youth Center ice rink. Jal-Con-Weld pipe was selected because of its successful performance in similar installations over the past 15 years. Architect—Alonzo J. Harriman, Inc. Contractor—Jarvis Engineering Company. Distributor—Independent Pipe & Supply Corp.

America's Next Ice Age is on the move

What started it? It started with man-made ice and a new awareness of the genuine enjoyment to be found in skating. But nationwide interest in ice sports really began with the wide-spread application of dependable, low-cost refrigeration systems of *steel pipe.*

Steel piping systems, with their low initial cost and low-cost long-term maintenance, have made it possible for almost every community in the country to build an ice rink, permitting a full season of fall and winter skating.

Now, every year, more communities are building rinks wisely and economically with steel pipe. Many steel pipe rinks have been in operation for more than 20 years.

J&L's Jal-Con-Weld pipe is being specified for many of the new ice rinks. Close production control and rigid inspection assure a top quality product that will form and weld easily and provide dependable service for years.

Ask your nearby J&L pipe distributor for details, or write direct.

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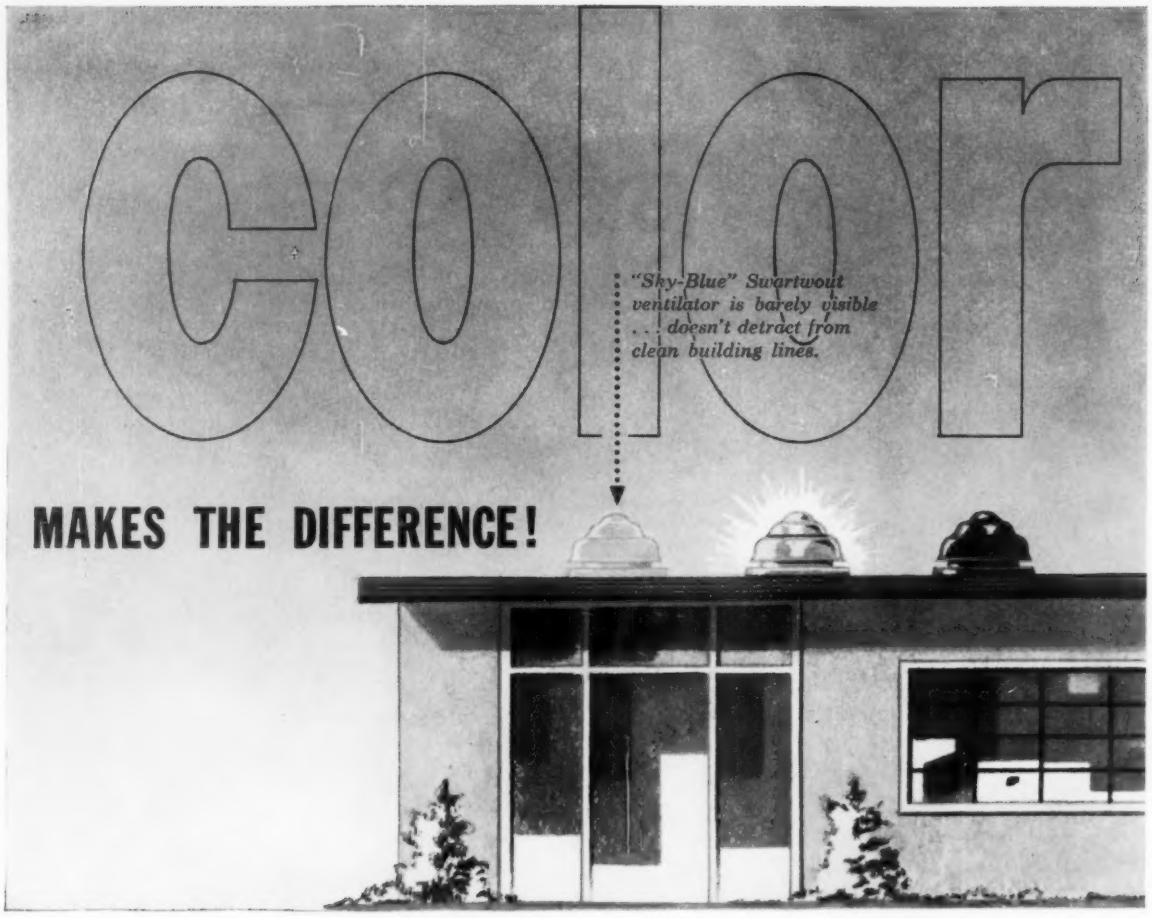

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No more annoying glare of aluminum . . . no more distracting heavy appearance of dark colors. When Swartwout introduced its new Fiber-Aire units with molded-in "sky-blue" color, compliments poured in from architects, engineers, contractors and building owners praising this new color as the first ever used that prevented ventilators from marring the appearance of attractive buildings.

Now ALL Swartwout ventilators are available in "Sky-Blue"

While Swartwout's Fiber-Aire units have this color molded-in, other Swartwout ventilators are now available in "sky-blue" at the regular painting charge.
Keep your buildings' sky lines clean . . .
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Pulaski Elementary School, Gary, Indiana. Architect: Caudill, Rowlett, Scott & Associates. General Contractor: Taylor & Taylor. Heating Contractor: Quality Heating & Air Conditioning Company.

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Especially designed for use in slab perimeter heating, cooling, or combination systems, SONOAIRDUCT handles easily, levels and joins quickly. There are no sharp cutting edges, and it won't chip, crack or break when dropped—every piece is usable! With economical SONOAIRDUCT Fibre Duct, both contractors and owners save time, labor, and money.

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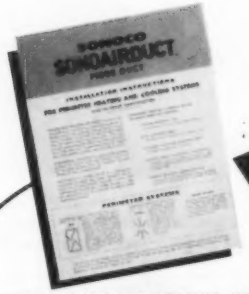

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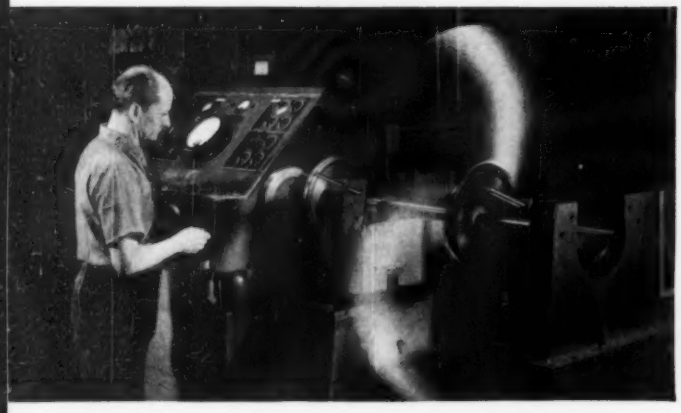

In Balance. Ilg-built fan wheels pass rigid dynamic balancing tests before being direct-connected to Ilg-built 3-phase or permanent-split capacitor 1-phase motors.

Five Fan Sizes. Airfoil-design blades are available in five sizes: 24, 30, 36, 42 and 48 inches. Sizes from 24 through 36 inches have steel blades; sizes 42 and 48 inches are aluminum.

Mount a new Ilg Type UB "Upblast" Ventilator directly over a roof opening and you get high-speed, vertical exhaust from either duct or open areas. Airfoil-design propeller blades are direct-connected to Ilg-built totally enclosed motors for vibration-free operation.

Sturdy steel housing . . . weather-tight steel frame . . . gravity-type butterfly damper provide all-weather protection. Five fan-wheel sizes: 24, 30, 36, 42 and 48 inches; capacities from 5060 to 33,300 cfm. WRITE FOR BULLETIN 4809.

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"Will Redesigned Steam Header Using Same Welding Cap Be Safe?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other solutions appeared in the September 1959 issue. Other comments and answers to this question for publication are invited.

"I am in the process of redesigning a 12 in., extra heavy, ASTM-A 106 Grade B steam header for steam at a pressure of 450 psi and at a temperature of 750 F. The header is to be lengthened.

"I plan to cut the present header at the cap weld, attach the required additional length of pipe, and use the same welding cap to close the new length.

"The header has been in service for about three years, intermittently. The temperature in the header has reached 800 F as the maximum during some of the cycles of operation.

"I would like to know if it is safe to use the end cap in this redesigned steam header. Also, what special precautions should be taken in the fabrication of this new header if it is safe? Would it be acceptable to weld the new length of pipe to the header where the former welding joint has been?"—J.G.

Check for Graphitization First; Restore Beveled Ends for Fit-up

WITH A STEAM condition of 450 psi and 750 F, there would be no question as to the stability of the ASTM-A 106 Grade B steel pipe. However, since 800 F temperature was and will be attained, a small element of doubt should be considered.

It is only a remote possibility that in three years of service the 800 F temperature may have caused some segregation of graphite in the heat affected zone of the butt weld. This would be more likely if this pipe were made from a heat of steel that was heavily treated with aluminum in its manufacture. If this doubt is to be reckoned with, despite its remoteness, then a boat sample should be cut from the weld and subjected to metallographic study.

The June 1959 Heating, Piping & Air Conditioning contained an interesting article about graphitization of carbon steel welds at 800 F. (*Carbon Steel Has Its Problems, Too; When Piping Steam at 800 F,* by I. A. Rohrig.) Reference to this excellent treatment of the subject is recommended.

I would suggest that, after the butt weld at the end of the header has been cut, the bevel on the welding cap should be restored, preferably by machining. The bevel on the end of the existing header should be restored by flame cutting and subsequent grinding. A good fit-up of beveled ends is needed for achieving a sound butt weld. The two new butt welds should be made with backing rings in the pipe, in my opinion.

G. W. HAUCK
Assistant General Manager
Engineering Sales Dept.
Crane Co.

O.K. — If Wall Thickness of Pipe Complies with Pressure Piping Code

WHEN HE IS cutting the header, it would be advisable for J. G. to stay several inches away from the original cap weld. If the cut is made at the weld, the squaring and rebeveling of the cap might shorten it to the point where it would be awkward to handle.

After cutting the header, the wall thickness of the existing piping should be checked. We have assumed that the steam header has been designed in accordance with the

question of the month

Continued

requirements of the ASA Code for Pressure Piping. Therefore, the following calculations give the minimum required wall thickness:

P = 450 psig
T = 800 F
D = 12.75 in.
Material = A-106 Grade B
$S_{allowable}$ = 10,000 psi at 800 F
t_m = 450 × 12.75/[2 (10,000)] + [0.8 (450)]
= 0.282 in.

This t_m of 0.282 in. is the minimum allowable thickness under the power piping section of the ASA Code for Pressure Piping. To this minimum thickness should be added an allowance for corrosion. In this particular case, in our opinion, it would be advisable to determine the amount of corrosion that has already taken place in the last three years of service and possibly add that amount to this minimum thickness.

After arriving at his total desired wall thickness, J. G. should check his existing pipe to see that it is at least equal to this. If it is, we see no reason why he should not rebevel and insert any desired length of 12 in. extra heavy A-106 Grade B pipe for the header extension.

FOSTER W. HOLMES
Staff Engineer
Midwest Piping Co., Inc.

"How Much Heat for Dry Kilns?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with an answer that has been received from a reader. Other answers appeared in the November 1959 issue.

"A plant making veneer crates for fruit has two dry kilns, each 7 × 22 × 120 ft. A total of 8000 wet crates are put through these each day and each crate contains about 8 lb of water. Banks of steam coils at one end with powerful exhaust fans at the other end furnish the present drying medium.

"The plant is shut down on Saturday, but the owners want to install auxiliary heat to make it possible to operate the kilns on that day.

"What is the amount of heat required for this application? In my effort to locate a direct fired heater, I have estimated the heating load to be from 280,000 to 6,400,000 Btu per hr, but I feel that my answer needs checking."
H.W.H.

Must Analyze Operating Conditions To Determine Exact Heat Demand

THE INITIAL water content of the crates is 64,000 lb (8000 crates containing 8 lb of water each). To determine the amount of water to be evaporated, we assume that the final water content of the crates is 8000 lb (1 lb of water per crate). Thus, 56,000 lb of water has to be evaporated every 24 hours. If one hour is lost for loading, unloading, and heating up the kilns, then only 23 hours are left for the actual drying operation. For ideal continuous operation, the average evaporation would be 56,000/23 = 2430 lb per hr.

Assuming now that the kilns are in good condition and that there is good air distribution, good insulation, and little air infiltration, the heat required for evaporation will be 250 percent of the theoretical value. Since the latent heat is approximately 1060 Btu per lb of water, the heat required to evaporate 1 lb of water in the kiln is 2.5 × 1060 = 2640 Btu per lb, and the total heat required for the two kilns is 2430 × 2640 = 6,400,000 Btu per hr.

To determine the exact heat demand the existing operating conditions must be analyzed:

1) *Measure steam consumption.* If a steam meter is not available, measure the condensate with a hot water flow meter or with an old drum and stop watch.

2) *Weigh the batch before and after drying* to determine the actual water evaporation.

3) *Plot the actual drying process on the psychrometric chart.* This is done as follows: (a) measure the dry bulb and wet bulb of the air entering the heater and also the temperature of the air leaving the heater; (b) measure the dry bulb and wet bulb temperatures of the air exhausted from the kiln.

4) *Compute the heat loss of the kiln* from construction data, k factors, and film coefficients.

5) *Estimate infiltration loss* if the kiln structure is not airtight and in accordance with suction in the kiln.

The heat demand computed from the psychrometric chart and the heat losses should then be compared with the steam flow measurements for a final check. Allowance must be made for cold winter conditions. Since this is a batch operation, all measurements have to be taken several times over the drying cycle.

L. G. MATHYS
Consulting Engineer

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That's why Uni-Silencers were specified for the First National City Bank Building in New York City. That's why their *certified* performance data is *guaranteed in writing to you,* and bonded by an eminent insurance company.

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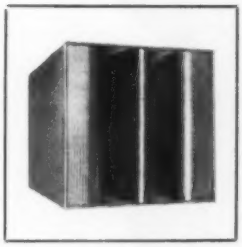

Uni-Silencers, made in sensible, small, manageable units, are slip-joined, like children's building blocks, making for simple installation to fit almost any structural requirement. There is a range of 7 models to reduce effectively the airborne noise generated by fans in air conditioning and ventilating systems and by power roof ventilators. Special units are engineered for unusual job conditions.

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SCHOOL HEATING JOB SHOWS:

Vacuum Steam + Outdoor Reset = Simple, Reliable Heating Control

• Vacuum steam and outdoor reset control—these two simple items can bring to an end the problems of sporadic operation of some steam heating systems, according to the author. With outdoor temperature constantly measured by an outdoor bulb, which in turn resets the control point of a vacuum regulator, a uniform flow of controlled steam is available to all heating units, regardless of location. This article describes the design of such a system and relates the results of tests which reflect the economics of its use.

Mr. Krapek, born in Czechoslovakia, is a naturalized U. S. citizen and attended Alma (Mich.) College and is a graduate of Aeronautical University. He is a registered professional engineer in Michigan and Indiana and a member of several engineering societies and associations.

By ANTON KRAPEK
Vice President
E. Roger Hewitt Associates, Inc.
Professional Engineers

OVER THE YEARS, many types of heating systems have been developed. Each in its own place, these systems seemed to answer the purpose for which they were designed. Even today, there is a proper place for the various available heating methods, be they steam, warm air, hot water, or electricity. One medium will usually serve the intended purpose better than another, depending upon the use of the building.

In the last eight years, our firm has designed heating and ventilating systems for a number of elementary schools throughout Michigan. The basic system selected for many of these is steam, with pipe tunnel

Fuel consumption comparison proves system's economics

distribution. Heat delivery in classrooms is provided through unit ventilators, while convectors, fin-tube, baseboard, or cabinet unit heaters are used in non-teaching areas.

Usual steam heating practices almost automatically dictate pipe sizing methods and there always is the remote possibility that end-of-the-run radiation might possibly be starved during pickup periods. At this point then, we strayed from the basic steam system as such. After considerable research we decided upon the use of a high vacuum steam system coupled with outdoor reset control.

In the use of high vacuum, pipe sizes can be reduced and steam is readily available to all radiation, regardless of location. Also, the temperature control point can be set back at night or during weekends since the building can be easily warmed up when so required.

Along with the outdoor reset control, a main line control valve is installed in the steam supply immediately after the main leaves the boiler equalizer connection. As an end result, vacuum steam and outdoor reset control form the basis for system operation.

Major Controlling Is Done Within Mains

With the use of outdoor reset control, the major amount of controlling is accomplished within the mains themselves. Steam pressure varies from 2 psi to 20 in. Hg vacuum and steam temperatures vary from 218 F to 161 F. With this range available to the heating elements, only a slight amount of duty is left for the space controls to do. Operation is such that the controls can modulate within their normal range, eliminating over-ride conditions and preventing the possibility of hunting.

With this combination of equipment, control is greatly simplified since the heating capacity varies with changes in outdoor temperature. Since the steam pressure is automatically controlled from 2 psi in cold weather to 20 in. Hg vacuum in mild weather, steam has roughly three times its volume at this vacuum than it does at 2 psi and its temperature is correspondingly reduced from 218 F to 161 F. With a maintained close pressure differential, this low temperature steam provides constant filling of heating elements as outdoor temperatures moderate. Thus, sporadic heating effects are eliminated, and a uniform flow of controlled steam is available to all heating units, regardless of location.

In actual operation, the outdoor temperature is constantly measured by the outdoor bulb which in turn resets the control point of the vacuum regulator within the control cabinet. The regulator operates the high vacuum pump in an *on-off* manner to maintain the vacuum range of the return lines as dictated by the outdoor controller. The vacuum thus maintained within the return lines acts directly upon the control valve diaphragms which regulate the pressure, temperature, quantity, specific volume, and pressure differential of the steam entering the system. Load changes cause the valve to admit either more or less steam, as required by the heat transfer equipment, since the diaphragms controlling the valve are also activated by conditions within the steam main.

Entire System Is Pressure Balanced

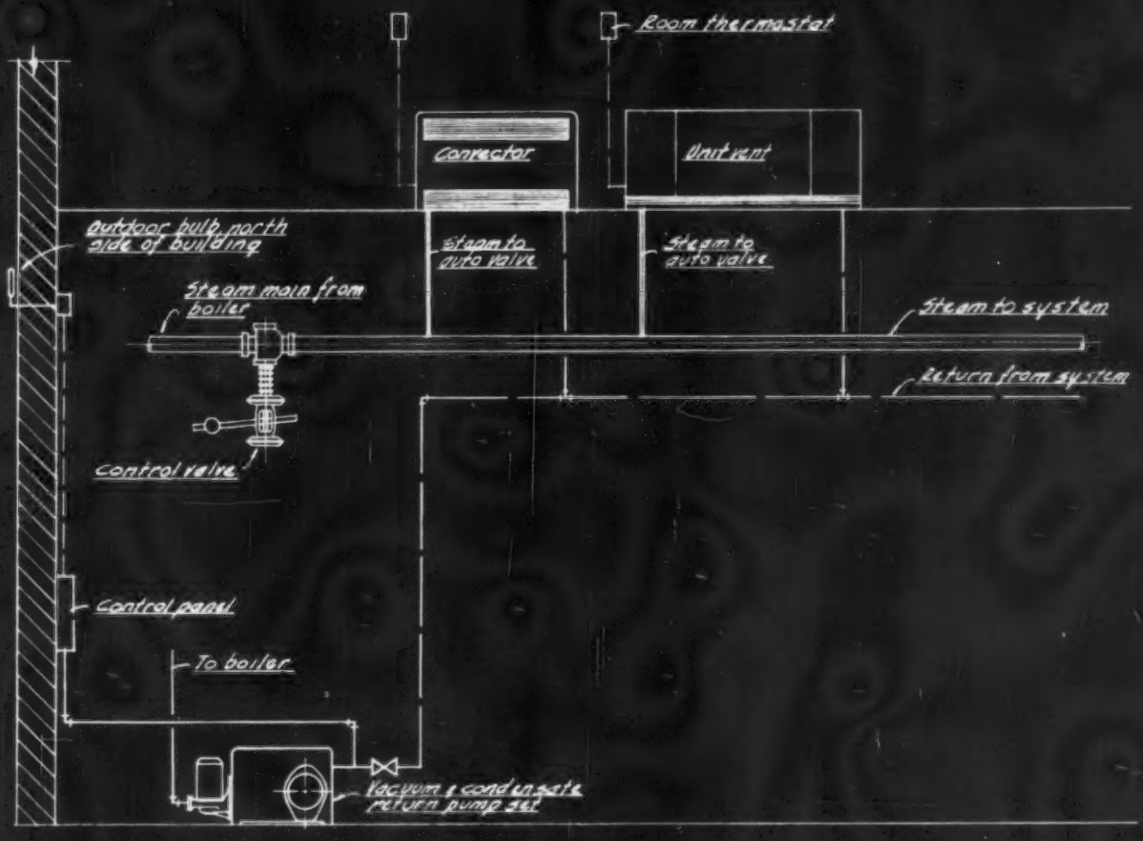
During the vacuum-maintaining-pump operation, air and gas accumulations are removed and the control valve responds to the vacuum rise, reducing the amount of steam entering the piping system to the point where there is no appreciable pressure drop. Thus, the entire system is pressure balanced, making relatively the same pressure available to all radiation, regardless of its location in the piping system. Since the entering steam volume is less than the air volume removed by the pump, the steam is forced to expand as it is drawn into the heating elements to replace the withdrawn air.

School Job Provides Test Results

Our first school project having outdoor reset control was Gier Park School in Lansing, Mich. In addition to unit ventilators, convectors, etc., the system consists of vacuum sized mains, heavy oil preheating equipment, an oil burner, a high firebox welded steel boiler, and pneumatic individual room control. The burner is arranged to cut in at a steam pressure of 2 psi and out at 5 psi.

A series of tests was made at the request of the Board of Education to compare the amount of fuel consumption at various outdoor temperatures, with and without outdoor control. Test series were made during one heating season to provide a complete cross-section of conditions. Temperature ranges were 39 to 48 F in the first series, 32 to 37 F in the second series, 13 to 18 F in the third series.

During each series of tests, the heating system was operated alternately, first with outdoor control and then without. With outdoor control, a variable sub-



PIPING SCHEMATIC for typical vacuum steam heating system with outdoor reset control illustrated above. Vacuum regulator operates high vacuum pump *on* and *off* to maintain vacuum range of return lines as dictated by outdoor controller. Vacuum in return lines acts upon control valve diaphragms which regulate steam entering system

atmospheric pressure was maintained on both the steam and return mains, with an average pressure differential of 1½ psi (3 in. Hg). Without outdoor control, the full boiler pressure, varying from 2 to 5 psi, was maintained in the steam mains while a low vacuum of from 3 to 8 in. Hg was maintained on the returns. This gave an average pressure differential of 6¼ psi instead of 1½ psi. Changing from outdoor control to boiler pressure operation was accomplished by simply blocking the control valve wide open and controlling the vacuum pump with a low vacuum regulator. Room thermostats were checked and set to maintain a minimum space temperature of 74 F.

The rate of fuel consumption was accurately determined by timing the *on* and *off* periods of burner operation during each test period and then calculating the percentage of the total time the burner was *on*. This percentage of *on* time for each test series was adjusted to compensate for outdoor temperature variations, making it possible to compare the resulting percentages directly.

The following table will show the results of the test series.

	Test series No. 1	No. 2	No. 3
Outdoor low temperature, F	39	32	13
Outdoor high temperature, F	48	37	18
Average outdoor temperature, F	43.5	35.5	15.5
On time less control, percent	38.2	49.1	39.5
On time with control, percent	30.5	40.1	33.0
Difference, percent	7.7	9.0	6.5
Fuel saving, percent	25.2	22.4	19.7

From the above data, the overall fuel consumption would be increased by at least 22 percent without the use of the outdoor control package to supplement the individual space control. As the building becomes older, the difference without outdoor control would become greater due to trap leakage caused by the excessive pressure differential maintained.

The mechanical (heating, piping, and air conditioning) contractor for the Gier Park job was Hoxsie Plumbing and Heating Co. The consulting engineers were E. Roger Hewitt Associates, Inc. Simpson and Hartwick were the architects. ⧺

MILITARY PARK three-level underground garage will look like this when completed, according to architect's rendering. Exhaust air will be released through octagonal-roofed kiosks; outdoor air will enter via rectangular-shaped structures

How Newark Underground Garage Is Ventilated

Presently under construction, downtown Newark's $5.6 million underground parking garage will feature a dual system of forced supply and exhaust ventilation designed to provide 1.15 cfm of air per sq ft of total floor area to maintain safe carbon monoxide concentrations—even during rush-hour traffic. Quiet fan operation was a design factor, too, to enhance the esthetic appeal of the city park area above.

A DUAL SYSTEM of forced supply and exhaust ventilation has been developed for the three-tier, 1031-car underground parking garage being built beneath historic Military Park in the downtown business section of Newark, N.J. The $5.6 million facility, sponsored by the Newark Parking Authority, is scheduled for completion early next year.

The reinforced concrete structure, which utilizes flat slab floors supported by drop-head columns on concrete footings, will have a total floor area of 432,929 sq ft and a total cubage in excess of 5 million cu ft. The roof will be 4 ft beneath grade level, with the floor of the lowest tier 34 ft beneath the surface. Four ramps will provide access and exit lanes for the garage.

As a preliminary step in the design of the ventilation system, a survey of existing underground garages was made by the consulting engineers, who also contacted various agencies which had performed actual studies of carbon monoxide contamination levels in such facilities. Careful correlation was effected between the data thus obtained and the economic considerations of the project.

The ventilation requirement of 1.15 cfm of air per sq ft finally selected as a basis for the system design is considered to represent an improvement over conditions obtained in most of the existing installations studied.

To obtain a carbon monoxide dilution of less than 1 part CO in 10,000 ppm of air by volume, the system will employ four 90,000 cfm supply fans and eight 50,000 cfm exhaust fans. Either set will be capable of providing 10 complete air changes per hr. A safe contamination level will be maintained using only the exhaust system, with supply air entering via the automobile ramps—a method which is used in some other structures of a similar nature. The additional supply fans in the Newark facility, however, will insure an adequate volume of outside air, even during periods of peak use when the great number of cars on the ramps might ordinarily increase the CO content of the entering air substantially.

Supply air will enter, via shafts to the park's surface, through disposable glass fiber filter banks. The air will be tempered to 40 to

45 F when necessary for patron comfort and to keep the fire sprinkler system from freezing. Heating will be accomplished by dual-valve steam coils supplied by two 8360 lb per hr steam boilers located in an equipment room on the first tier. A thermostat in each discharge duct will control the heating for the garage area, while a second thermostat in the intake plenum of each fan operates to deliver steam to the coils during periods of low ambient temperatures when the fan is idle.

Vertical supply risers with cross-sectional dimensions of 12 × 5 ft are being installed at the center of each peripheral wall to deliver air to each of the three tiers. Two supply registers at each level will direct incoming air from each duct toward the center and peripheral areas, using manual volume and directional dampers. Automatic fire dampers are installed between tiers.

Approximately 60 two-ft square exhaust registers are to be spaced in vertical pairs in risers positioned every 55 to 60 ft throughout the center and perimeter areas of each level. All exhaust risers on the lower two levels will be connected to a peripheral collection duct located beneath the ceiling of the first tier. The collection ducts terminate in exhaust plenums in the ceiling.

Maintain Low Noise Levels

Since quietness and appearance were of immediate importance in the surface park area, all supply and exhaust fans will be located on the first, or top, tier, providing room for the installation of sound dampers between the fans and ground level, a distance of 4 ft. Each fan will discharge into the center of a 12½ ft octagonal concrete plenum through a 5 ft square opening.

Within the plenum, two rows of alternately placed hexagonal metal sections will extend across the entire damping area, producing a sound-trap air flow pattern. Air is to be discharged, through a 9½ ft opening to an octagonal air diffusing kiosk above grade, to the atmosphere via the entire perimeter of the structure. The ornamental kiosk, which will be 9 ft high, is designed to complement the landscaping of the park. One such exhaust system will be installed first, and used to obtain operational data relative to the diffuser spacing necessary to eliminate any predominant frequency which might prove annoying.

A careful study was made to avoid the possibility of objectionable fan noise in the park area. Airfoil centrifugal fans were selected. These have a sharply rising pressure characteristic throughout the operating range, and will operate in the vicinity of maximum efficiency near the peak of the pressure curve. Turbulence noise will thus be kept to a minimum.

The highest noise level produced by a fan will be in the low frequency range below 100 cps. The noise attenuation provisions made to reduce noise in these frequencies presumably will attenuate those of higher frequency also. The system as designed will, however, cover the entire audio frequency range.

Monitor CO Concentration

Both supply and exhaust fans are to be controlled by an automatic carbon monoxide detection system with an overriding manual control feature. Thirty-eight sampling orifices scattered throughout the parking areas on the three tiers will be connected by copper tubing to five analyzers installed on a control board in the garage manager's office.

Each analyzer consists of a sensing device with integral meter, eight solenoid valves, and a flow meter; a three-way valve for admitting sample air, outside air, or calibrating sample, calibration and test controls; and a constant voltage transformer to provide power for the analyzer and pilot light circuits.

The sensing device will operate on the principle of direct deflection. The amount of infra-red rays of a fixed wave length which is absorbed by the sample will indicate the CO concentration in the sample. The device is balanced at zero concentration for sample or outdoor air inputs. The off-balance signal delivered when CO is present in the sample will be fed to a pneumatic detector-receiver alternately with the fixed comparison or outdoor air signal. The resulting change of temperature and pressure in the detector will cause an oscillation of the detector diaphragm, creating a signal which is amplified, filtered, and rectified to operate the meter and recorder. A red light will appear on the control panel and a buzzer will sound simultaneously. The analyzer signal automatically activates the supply and exhaust fans serving the area of the garage involved.

Provision is made for manual control of the fans if the board attendant does not want to wait for the slight time lag involved in the action of the analyzer equipment. A time-graphic recorder will operate to record the various concentrations over a 24-hr period. It is expected that these records will in time provide a pattern of concentration that will serve as a valuable guide to operational requirements, since it will indicate busy and slack periods.

Enclosed public, administrative, and employee facilities in the garage are designed to have an independent supply and exhaust system linked to small surface outlets. These areas are to be pressurized to resist air infiltration from the parking areas.

The ventilating systems were designed by Visco, Franzblau Associates, consulting mechanical engineers. The heating and ventilating contract for $329,929 has been awarded to F. P. Farrell, Inc. The architect for the garage is Frank Grad & Sons. ≠

Why Markings Are Important on Welding Fittings and Flanges

Markings on welding fittings and flanges indicate that these products meet the requirements of the various standards and codes that have been established to assure satisfactory performance on the job. Users need to know what they're getting and that the requirements of the piping service will be met. A recent ruling of the Bureau of Customs requires marking the name of the country of origin on imported welding fittings and flanges in such a way to remain legible after sand blasting and painting.

ON ANY PIPING installation—as with practically any other part of a construction job—the contractor is faced with the possibility of call-backs to make changes, corrections, etc. This is a responsibility that he accepts when he bids the job. When it comes to the heavy duty welding fittings, the responsibility is an important one because any failure can be quite damaging and certainly expensive.

Because welding fittings and flanges are so important to the performance of a piping system, they have been carefully evaluated in terms of the jobs they must do and then precise standards have been set up which they must meet. These standards have their symbols, and all these products—or at least those of domestic manufacture—are marked with the proper symbols. These products are manufactured in strict accordance with the current applicable standards.

The markings are extremely important. They give such information as dimensions, grade of materials, and most important, positive identification of source. Manufacturers have developed an elaborate system of quality control. The fitting and flange manufacturers maintain a permanent record of the chemical composition and physical properties of every lot of steel received from the mills.

What Do The Markings Mean?

U. S. produced welding fittings and flanges are manufactured in strict accordance with current applicable standards, tentative standards, standard practices or recommendations as issued by such regulatory bodies as the American Standards Association (ASA), American Society for Testing Materials (ASTM), American Water Works Association (AWWA), Tubular Exchanger Manufacturers Association (TEMA), Manufacturers Standardization Society (MSS), military and other governmental departments, etc.

On a typical and properly marked fitting, the manufacturer's name and trademark, the material designation, wall thickness classification, and the nominal pipe size will be shown. For example, a 4 in., standard wall, grade B carbon steel fitting will be marked:

4"STD—This indicates the fitting is 4 in. nominal pipe size, standard wall thickness. Or schedule number may be given instead of STD., etc.

THE MANUFACTURER'S trademark, the manufacturer's name, and perhaps also the manufacturer's tradename.—Either the trademark or the manufacturer's name is sufficient, but it must appear on every fitting and flange unless the size prevents. This is the last mark that may be removed if size reduces the marking area.

WPB—Material.

ASA B16.9 covers the fundamental requirements for steel butt welding fittings, including marking, dimensions, tolerances, etc. ASA B16.5 covers the fundamental requirements for forged steel flanges, including marking, dimensions, tolerances, etc. Other dimensional standards are SP 43—stainless steel butt welding fittings; SP 44—transmission line flanges; AWWA C207—steel pipe flanges.

Material requirements are covered in the following ASTM specifications: A 234—carbon and alloy steel welding fittings; A 403—stainless steel welding fittings; A 420—low temperature steel welding fittings; A 105—carbon steel flanges for high temperature; A 181—carbon steel flanges for general service; A 182—alloy steel flanges for high temperature service; A 350—low temperature steel flanges.

Foreign Markings Removed

Markings on welding fittings and flanges have recently come under surveillance because it has been noted that certain abuses have crept in that are in violation of U.S. law and also put into jeopardy the work of some contractors.

In the course of a six month investigation, a large number of deceptions were uncovered which seemed to be designed to keep engineers and contractors from knowing what kinds of welding fittings they were actually using. Over and over again, instances of imported fittings and flanges that "lost" their markings were found. The means used to remove these markings were almost as varied as the number of people handling them. For example, such techniques as overpainting, sandblasting, dipping, grinding and chipping were common.

A recent case is highly illustrative. A fitting turned up bearing a wholesaler's trademark but no manufacturer's trademark—this in violation of the ASTM standards. The fitting was taken to a laboratory, and it was found that the original name of the country of origin had been die-sunk, but then removed in this country through grinding. Then the wholesaler's own trademark was die-sunk in the same spot.

For an assortment of reasons, it seems to have been the practice of many overseas manufacturers of welding fittings and flanges to use methods of marking that are incomplete and inadequate. Many don't even show the country of origin. The reasons for this probably range from carelessness and unfamiliarity with U.S. Customs requirements to downright deception. And the deception has been compounded by some importers that sandblast and paint over to obliterate markings.

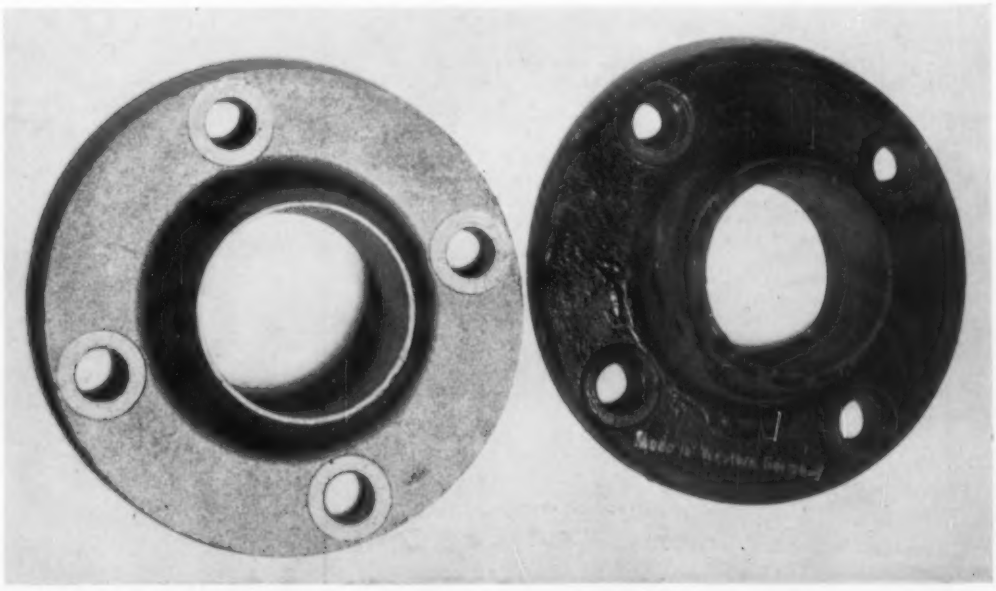
Costs Contractor Thousands

This sort of "re-conditioning"—which produces fittings that lack vital markings and identity—has been turning up with increasing frequency. That this lack of identification can result in direct loss to a contractor was proved recently at a new naval hospital that was nearing completion when it was discovered that unmarked fittings were being used. The contractor was obliged to cut a large number of his lines and re-install properly marked pipe fittings—at a cost of thousands of dollars. In this particular instance, this had to be done to comply with the government specifications for the installation that all piping materials be of domestic origin. Of great interest is the fact that while the correction of the work proved to be very costly, the evidence indicates that the contractor had no knowledge of the violation until it was brought to his attention through this drastic action.

Why such practices? Obviously, it seems, with the hope that the lack of identification will allow the material to get by as being of U.S. manufacture inasmuch as there is no indication that it isn't. Specifications usually call for material that meets ASTM standards. In this way, the user is assured that his piping system will meet the requirements of these specifications. And the specifications usually are written so as to allow one of several kinds of U.S. made (and adequately marked) fittings to be used. But, if the inspection is not diligent and timely, unsatisfactory material of similar appearance might easily be worked into the job.

The ASTM specifications require that the welding fitting or flange carry the identity of the manufacturer. If this is missing, this is the easiest way to determine that the material is not of domestic manufacture. Some wholesalers have chosen to mark fittings with their own trademarks as well, which is perfectly permissible if this name is added to that of the manufacturer's mark. However, it cannot be substituted. Actually, when fittings carry only the trademark of the wholesaler, it can probably be usually presumed that the fitting or flange is of foreign manufacture.

AFTER CLEANING and painting (left view) in this country, the name of the country of origin of this flange was no longer legible



Customs Bureau Issues Rulings

In 1930, Congress passed a tariff act, an important aspect of which was the requirement that manufactured products entering this country be marked to give the name of the country of origin. At that time and for several years following, this requirement (as far as welding fittings and flanges are concerned) was purely academic. There were few imports of these items during those years.

Recently, however, there has been a great upsurge in imports of much "hard-goods merchandise"—including welding fittings and flanges. These items are entering this country in substantial quantities. Unfortunately, engineers and contractors seem to have been pretty much in the dark as to this fact. Deception is apparently being practiced, about which a special U.S. government marking directive and two supplements have been issued.

Because of supplement No. 2 to its letter No. 3089 issued by the Bureau of Customs on May 13, a far firmer situation is expected to develop. Deliberate removal of product identity has been made difficult by requiring one of three permanent means of marking—die-sinking, welded tags, or raised letters. As a result of this ruling, it can now be correctly assumed that a fitting that does not carry a manufacturer's trademark is of foreign origin. This should remove at least some of the mystery and confusion.

The piping specifications as usually written that pertain to welding fittings and flanges do not necessarily give complete protection against substitutions by improperly marked (and possibly inferior) products. The "or equal" phrase has been the breach in the dike through which improperly marked flanges and fittings have flowed. It is because markings have been incomplete or destroyed that the usefulness of "or equal" as a means of control is lost. To keep control in this important area, it is recommended that "approved equal" be used in specifications by designing engineers.

TREASURY DEPARTMENT

BUREAU OF CUSTOMS

WASHINGTON 25

In Reply Refer To
EV 363.2

May 13, 1960

BUREAU OF CUSTOMS
CIRCULAR LETTER NO. 3089, Supplement No. 2

SUBJECT: Welding fittings; marking of the name of the country of origin; section 304, Tariff Act of 1930, as amended.

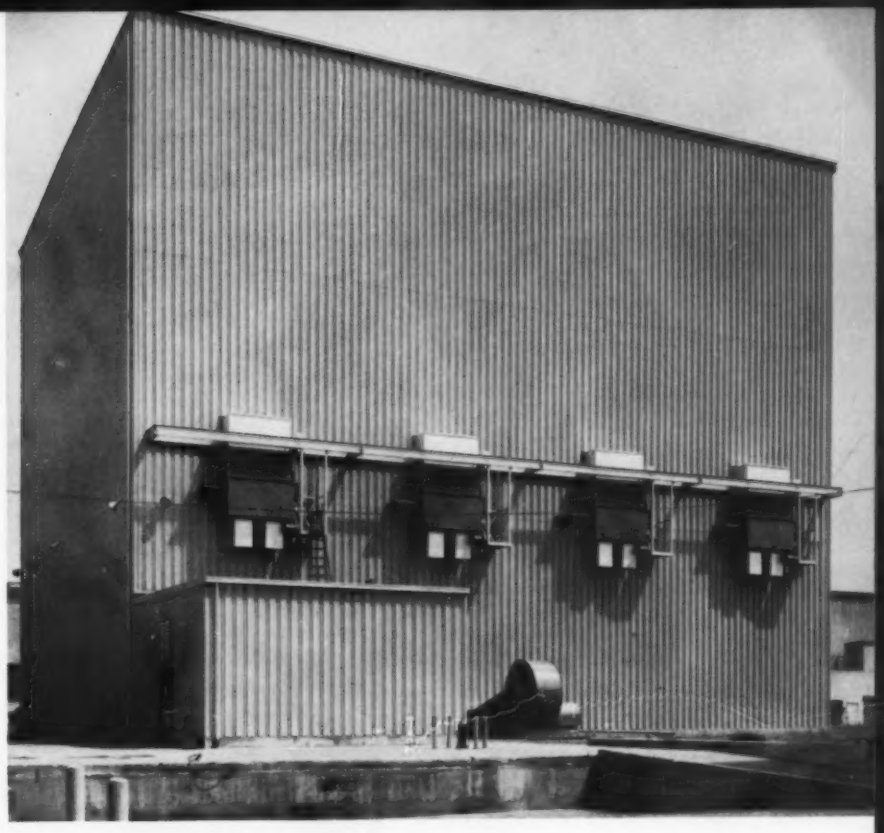
Information has been submitted that welding fittings marked with the name of the country of origin by stenciling are subjected after importation to certain cleaning processes, including sand blasting, and to painting which removes or obliterates the marking before it reaches the "ultimate purchaser."

Effective immediately, welding fittings, including welding flanges shall be marked with the name of the country of origin by means of diesinking, raised lettering, or by metal tags welded to the fitting upon which the name of the country of origin appears in raised letters or by diesinking. Such marking shall be of a size and depth that it will remain legible and conspicuous after blasting and painting in the United States.

(Signed) C. A. Emerick

Commissioner of Customs (Acting)

THE BUREAU OF CUSTOMS now requires that welding fittings and flanges be marked so that the name of the country of origin will remain legible and conspicuous after blasting and painting



NOT ALL industrial ventilation systems are as well-engineered as the one for this special electrical furnace building. Lower fan supplies outside air to pit. Four upper units supply mixture of outside air and recirculated air above ground level. Relief vents are located on roof

'Improper Ventilation' Scores Highest In Plant Engineers' Problem Poll

AIPE survey of engineers in new industrial plants gives clue to current building design inadequacies

By JOHN E. LOCKHART
Co-Chairman
Special Activities Committee
American Institute of Plant Engineers
and Mgr. of Plant Engineering
General Electric Co.
and C. F. MOWREY
Engineering Consultant
Plant Engineering Dept.
General Electric Co.

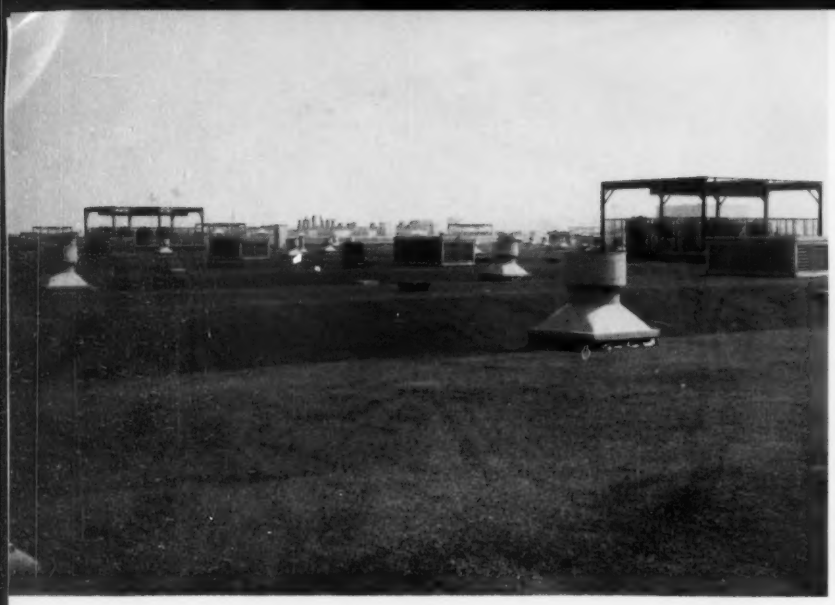
"NEW PLANT BUILDINGS lack proper ventilation equipment."

This complaint rang loudest in the 102 replies to a survey conducted by the American Institute of Plant Engineers. The questionnaire, to determine the problems of plant engineers with recently constructed buildings, was sent out to a random sample of AIPE members.

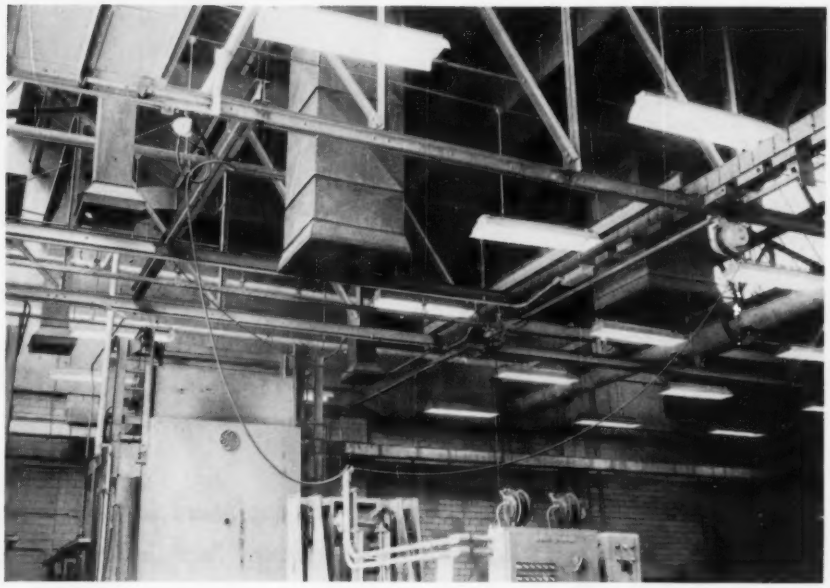
The results of the survey are of great significance when it is considered that the chief complaint—ventilating equipment—outweighed many other phases of building construction, including roofs, floors, walls, windows, doors, heating equipment, water systems, storm and sanitary sewers, lighting, electrical signs, foundations, plumbing, fire protection, basements, tunnels, docks, and parking facilities.

The survey covered normal manufacturing plants, warehouses, and special purpose buildings such as foundries, plating rooms, etc.

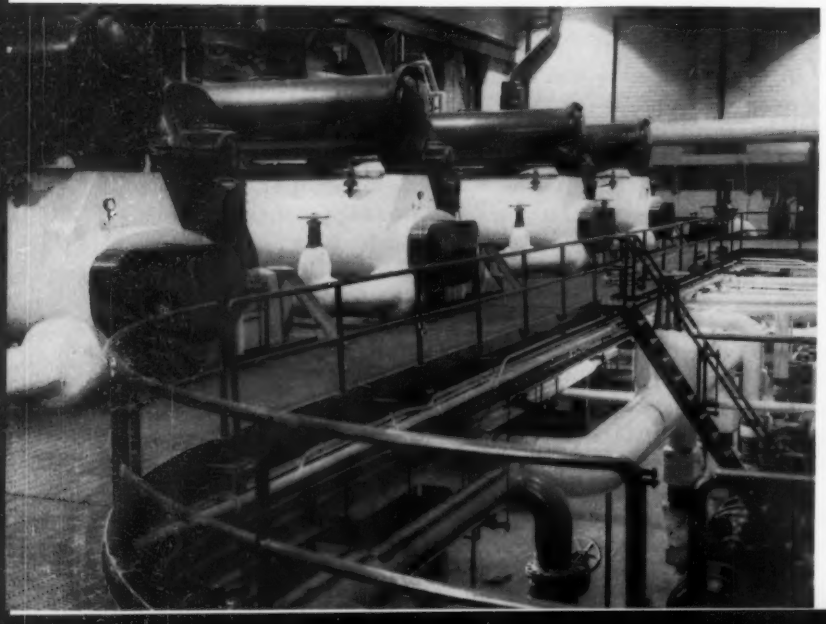
Each plant engineer was asked to cite four problem items in their order of importance to him. Results were scored on the basis of four points for an item indicated as a number one complaint, three points for a number two com-



THIS FACTORY ROOF personifies good ventilation design. Makeup air is drawn in through louvered inlets. It travels to fan coil units, then is distributed with recirculated air through duct systems



FIVE MAKEUP air units supply untempered air as required to general furnace room. In addition, two large duct systems deliver tempered makeup air to general area. Exhaust fans are on roof



THESE 1200 TON compressors provide air conditioning for special processes, laboratories, cafeterias, offices. In 10 to 20 years, air conditioning for worker comfort may be common

plaint, two points for a number three complaint, and a single point for a number four complaint.

Here are the scores for the top eight problem items:

1)	Ventilating equipment	118
2)	Roofs	102
3)	Floors	96
4)	Heating equipment	72
5)	Walls	61
6)	Windows	48
7)	Electrical systems	29
8)	Lighting	27

The returns indicate that, of all the complaints involving all problem items, over 25 percent made reference to ventilation and heating. Of these, 40 percent reported a lack of makeup air. These figures indicate the advisability of carefully analyzing both the known and the probable heating, ventilation, and air conditioning requirements when plans for new buildings are being formulated.

You'll find practical guidance on your plant ventilation problems in *Practical Industrial Ventilation Design*, by John H. Clarke. This collection of 10 articles is available from Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill. Price is $1.50.

Replies included not only the rated complaints of the individual plant engineer, but also his descriptive comments. Thus, there is indicated a genuine desire to cooperate in providing information which may be mutually profitable to plant engineers and others concerned. Several of these comments are presented at the right.

The results of the questionnaire appear statistically valid only for engineers in plants built within the past 10 years, since 94 percent of the respondents are so employed. The absence of replies from those in older plants adds to the importance of the findings and indicates that the problems reported might well be the result of current building practice. ∓

"IF YOU HAD IT TO DO OVER . . .

. . . would you use a different heating system, ventilating system, power system, or different equipment?" This question on the AIPE survey brought these and many other comments:

"Yes, more makeup air, better humidity control, better distribution."

"Would certainly get away from those large ventilating ducts, so bridge cranes could be higher."

"Provide for positive pressure in air handling, more capacity by oversizing vital units such as cooling towers, fans, compressors, etc."

"Definitely need an exhaust system."

"Use different ventilating system. Furnaces make operating area too warm, but no drafts can be tolerated. Have subsequently installed a massive air handling system with fair results."

"Would seriously consider air conditioning for all future buildings."

"Would study the ventilating requirements of the area before building in a strange area."

"Ventilating system would be redesigned to provide for more uniform distribution of exhaust ducts."

"Would combine heating and ventilating in insulated units on roof large enough for future air conditioning. Ten to 20 years from now, air conditioning for plant comfort will be common."

"Provide makeup air heating units capable of supplying all ventilating requirements, plus provisions in roof for 50 percent increase. Would use recording-controlling instruments in all critical air conditioning areas."

"Ventilating equipment not watertight."

"Inadequate to take all fumes away."

"All ductwork should be coordinated into its proper place."

"Heating equipment was misplaced. Unit heaters were not in desirable locations."

"Insufficient controls on heating systems."

"Maintenance convenience features weren't designed into the system."

"Since we removed 300,000 cfm from the building by ventilation and exhaust systems, two sections of outside wall were omitted and replaced with fin-tube heating coils to permit replacement of air removed and heating air at the same time. Drafts were created in these areas, and hot spots occurred in other areas. It was necessary that we install a series of baffles to reduce effect of drafts to permit lowering of temperature obtained by general heating of building."

"Heat Pumps Have a Bright Future"

. . . said Robert Morse Wood of Ebasco Services, Inc., addressing the recent convention of the Mechanical Contractors Association of America in New York City. On what does he base his prediction? This article, adapted from his presentation, cites several rules-of-thumb and design factors which can be used to indicate where heat pumps can be installed and operated satisfactorily.

FOR MAXIMUM year 'round comfort from an air conditioning system, we need to have heating, cooling, air cleaning, air circulation, and humidity control. All these can be supplied by the heat pump.

When used as a heating device alone, the heat pump is an expensive piece of equipment — at least in comparison with other types of heating systems. But when heating and cooling both are required, the heat pump will prove to be economical. A general rule of thumb is that if the ratio of heat losses to heat gains is between 0.4 and 0.5, the heat pump is likely to prove economical.

Most businessmen buy capital equipment for the long haul. They are inclined to buy the more expensive of two pieces of equipment if the owning and operating costs together are less than for the less expensive piece. The same is often the case in the selection of heating and air conditioning equipment.

From an electric load standpoint, the heat pump has marked advantages over other types of electric space heating because of the better annual load factor. However, when supplementary heating units are needed to carry part of the load, the performance factor declines and the load factor tumbles. But it must be pointed out that, as air conditioning became popular and its equipment improved, the immediate need of the utility was some means to balance that load in the wintertime. If a heat pump were not sold to do both jobs, then other methods of electric space heating would have to be substituted.

Before leaving the subject of load factor, it should be noted that, as a rule of thumb, a 10 percent increase in load factor can result in a 16 percent increase in the utilities return on investment. *This is a greater increase than the industry can expect from the introduction of nuclear energy.* It is also a fact that a 10 percent increase in load factor would improve utility earnings as much as 50 percent reduction in the cost of fuel for generating electricity.

The electric utility business is different from other industries. A few years ago a study showed that, for every dollar of revenue earned by an electric utility, 40 cents was paid out as fixed charges on the investment to earn that dollar. The ordinary manufacturer, when viewed similarly, paid only 7 cents of each dollar of revenue earned. Another way of saying this is that an electric utility must invest between $3.50 and $4.00 in plant and equipment for each dollar of revenue it earns, whereas other manufacturers need invest only about 35 cents for each dollar of sales.

The large investments which are necessary to produce such relatively small revenues may give you a clue to one of the most important facets of the electric utility business: the importance of load factor. Load factor in the electric industry is defined as the ratio of the average load over a period of time to the peak load occurring during that time. The period of time most commonly used is one year.

The higher a company's annual load factor, the more productive the equipment it owns (and pays fixed charges on) and, other things being equal, the more margin it has available for return to stockholders or to plow back into the business.

It is not surprising to note that load factor for electric utilities as a group was rising during the years that the average price of electricity was declining. Other forces were at work, of course. But improving load factors played an important part — and will continue to play an important part in the future.

High Lighting Levels Boost Cooling Needs

The Illuminating Engineering Society has just concluded a research project that may well revolutionize present lighting concepts. Briefly, the conclusions of the study were that people really need much more light to perform most efficiently the visual tasks they are now doing. In a way, this comes as no surprise. Most everyone recognizes that the most restful place to work is in the shade of a tree on a bright day, where the footcandle levels are 10 times the levels of most offices we consider well-lighted today. But what this study did was to provide a scientific basis for estimating the lighting needed for a given task.

High footcandle levels greatly affect the amount of air conditioning which must be installed. Each kilowatt of lighting introduces about 3500 Btu per hr into the lighted space. This is in addition to the heat gains of the building resulting from the outside/inside temperature difference, the loads created by the people in the conditioned space, sun loads, etc.

This heat must be removed during most of the year. It can be done by ventilation or by air conditioning. In either case, electricity is likely to be called upon to do the job — and this means higher summer peaks for the utility. It also means the need for compensating loads in the winter will be still greater if load factor is to be held steady.

Northern utilities also recognize that the demand on their systems created by air conditioning will be as great per square foot in the north as it is throughout most of the south. Air conditioning design criteria are about the same in Boston, New York, Chicago, Boise, Atlanta, Houston, and Little Rock. This does not imply that the northern utility will earn as much revenue from identical air conditioning installations in these cities, but the investment which will have to be made to serve comparable loads will be great, regardless of the city in which the load is located.

The importance of new lighting standards on the heat gains of the building was mentioned before. Its effect can be best illustrated by an example: Assume a building with a design heat gain of 10 watts per sq ft and an average level of illumination of 50 footcandles. This building would require about 1 watt per sq ft of air conditioning equipment just to remove the heat from the lights in the summer. In the winter it would require the equivalent of 7 watts per sq ft from the heating system. Summer load is only 0.4 of the winter load. However, if the average illumination in the building were raised to 200 footcandles — the desired level for a well-lighted office building under the new Illuminating Engineering Society standards — then the picture changes completely. Four watts per square foot of air conditioning equipment would be required to remove the heat from the lighting equipment in the summer and more than enough heat would be available from the lights alone in the winter. In fact, the building would require cooling even during periods of maximum heat loss if the lights were burning.

Control Lighting Equipment Thermostatically

When lighting levels are raised, this building automatically becomes a prospect for a heat pump. Heating would be needed only when the lights were off — such as at night and over weekends. But since the investment in lighting equipment is going to be made anyway, the capacity of the heat pump can be supplemented by thermostatically controlling the lighting equipment. Whenever the heat pump cannot carry the load at night or over a weekend, the lights can be made to switch on.

It is also a well-known fact that high-rise buildings generally require no heating in the interior. Since the heat losses occur mainly around the shell and roof, the building as a whole may be fairly well balanced. Whenever these buildings are designed with modern lighting, or will be occupied by large numbers of people, or will contain significant amounts of heat producing electronic equipment such as computers, then look for a prospect. Heat gains may very well exceed heat losses.

The same general considerations can be applied to industrial buildings. Here, look for large lighting loads, many motors, electronic equipment, and, of course, for ovens, furnaces, and other industrial heating devices. Keep in mind, too, that horsepower per worker is increasing every year. This market, like the commercial market, is changing continuously.

Another factor which should be considered in industrial work is the possibility of using waste heat

from industrial processes as a source of heat for the heat pump. The source must be dependable, adequate for the purpose, and economical to utilize. If it is, it may be the factor that tips the economies in favor of the heat pump.

Explore Heat Storage Possibilities

The adaptability of heat pumps — and their electric load characteristics — can be improved by heat storage methods. The climate of much of the U.S. is such that peak heating loads occur for only a few days each year. These peaks, however, rise high above the average load during the heating season. By using stored heat to shave requirements from the heating system, the load factor of the heat pump can be improved and operating costs reduced.

How much the load factor should be improved — and, consequently, how much heat to store — becomes an economic problem which is related to the cost of off-peak as well as on-peak electric energy, cost of the heating system (including the heat storage equipment) and the space available for heat storage.

Recognizing the possible economies of heat storage, a committee was formed within the electric utility industry. This committee engaged the services of a research organization to investigate the field and report findings. Among the possibilities so far considered are evaporator-side storage systems, condenser-side storage systems, and high temperature storage systems. These latter types are condenser-side systems, but are classified separately because of their unique characteristics.

The condenser and evaporator-side systems store heat generated by the heat pump during times when it has excess heating capacity and give it back to the system when the heat pump cannot meet all the demands. The high temperature systems are somewhat different in that they generally use resistance heating elements operated off-peak to generate the heat for storage rather than heat generated by the heat pump.

The amount of storage capacity needed depends upon temperature conditions and the improvement in load factor desired. The lower the design temperatures and the higher the load factor desired, the more storage capacity needed. Recent research has been guided primarily by a desire to improve the load factor of the load to about 30 percent and to let the size of the storage capacity vary with the design temperatures.

A load factor in this range can be attained in 5000 degree day temperature zones when the balance point of the heat pump is between 15 and 25 F above design temperatures and with a storage capacity of about 1 million Btu per hr. Storage capacity of this magnitude is enough to meet the most adverse weather conditions recorded in these zones. But since these conditions may occur only a few times in a century, some reasonable compromise may be warranted in practical applications to hold down equipment costs.

Research so far has not conclusively proved the superiority of any one heat storage medium. A number have been tried. Among these are water and ice, paraffin waxes, ceramic oxides, fused salts, and liquid metals. Each has proved to have both advantages and disadvantages. Water, for instance, is inexpensive, has high heat capacity, low corrosiveness, and excellent heat transfer characteristics; but large quantities are required and the tanks to hold these large quantities are expensive.

High Temperature Systems Furthest Along

The system which holds highest promise for the immediate future is the high temperature storage system charged with electric resistance heating during off-peak hours and using refractory oxides or anhydrous salts as the storage medium. These units could be built now as add-on units and sold separately for existing heat pumps. Next in preference are the condenser-side systems charged by the heat pump.

Because of the many uncertainties and relatively high initial costs — and in spite of the many advantages — heat storage systems have not yet been widely adopted for space heating applications. They may never be, depending upon fuel price trends and the ability of manufacturers to produce suitable equipment at a reasonably competitive price. However, they have been used on a limited scale on certain utility properties when the utility has developed a special, off-peak rate to attract this kind of business. It is reasonable to assume that, if these systems are further improved, many more utility companies will develop off-peak rates to attract this kind of business. Several are considering such action now.

Weigh Other Factors If Costs Are Competitive

Equally as important as operating and equipment costs in an analysis of where heat pumps can be sold will always be other advantages of heat pumps. Such factors as elimination of chimneys, absence of fuel storage requirements, automatic operation, elimination of the need for constant attendance, cleanliness, and flexibility may decide the issue when costs are reasonably competitive. All these factors must be weighed in the balance before a decision is made between the heat pump or other source of heat.

Summing up this discussion of where heat pumps can be applied economically, it may be said that customers are prospects when they want air conditioning, when the heating load is less than the cooling load, where operating costs are favorable or where the inherent characteristics of heat pumps answer specific customer needs. ∓

COAL

What every engineer should know

Coal is a vital fuel in our industry. Millions of tons are burned each year to generate heat for many applications. How much do you know about it—its origin, availability, reserves, types and heat content? How is it used? Herein, Heating, Piping & Air Conditioning embarks on a question-and-answer series that will cover these and many other facets of this all-important heat source. Willie Hammer, a frequent contributor to this publication, has done considerable research in preparing this compendium of valuable information.

BY WILLIE HAMMER
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Q. What are the different types of solid fuels?

A. Coal, coke, peat, and industrial wastes such as sawdust and shavings, tanbark, and bagasse.

Q. Which of these are commercially important as fuel?

A. Coal and coke are, on a worldwide basis. Peat is used as fuel in a few countries but not in the U.S. Wood wastes, tanbark, and bagasse are locally important to those industries in which they are residues.

Q. What is the availability of coal compared to other commercial fuels?

A. According to the Bureau of Mines, the recoverable reserves of coal in the U.S. are more than 940 billion tons, while those of petroleum, natural gas, and oil shale add up to the equivalent of 90 billion tons.

Q. Which areas of the U.S. have the greatest reserves of coal?

A. North Dakota has about 175 billion tons and Montana 110 billion tons of recoverable low grade coal, Illinois has more recoverable high grade coal than any other state, with more than 68 billion tons. Other leading states with large tonnages of recoverable reserves are Wyoming, 60 billion; Kentucky, 59 billion; West Virginia, 52 billion; Colorado, 49 billion; Utah, 46 billion; and Pennsylvania, 35 billion.

Q. What is meant by "recoverable reserves"?

A. Recoverable reserves are those amounts of coal which are economically minable by present methods. They are estimated to be one-quarter to one-half of the coal in the beds. The amounts which are not recoverable are those which must be left as mine pillars; in thin seams; under roads, streets, streams and lakes, railroads, or buildings; or in distant or inaccessible areas.

Q. About how much coal is produced annually in the U.S.?

A. In 1957 nearly 500 million tons worth almost $3 billion at the mines were produced. It is estimated that this amount will be exceeded in 1960.

Q. What was the origin of coal?

A. Coal was formed from vegetation which fell over periods of thousands of years into bogs and marshy areas. In the first stage, peat was formed from the accumulations of leaves, trunks, and branches of trees, seed, spores, grass, and moss which un-

derwent biochemical decay caused by the action of bacteria and/or fungi. This ended when the peat was buried (cutting off the oxygen required for the biochemical processes) or by development of adverse conditions which killed the bacteria. Later, pressure generated by added layers of vegetation and sediment, and especially by movements of the earth's crust, coupled with heat, caused futher changes in the cellular structure of the whole mass, dehydration, and compaction. The intensity and duration of the various actions determined the type of coal which resulted. The greater the pressure and temperature, the greater was the loss in volatile matter and oxygen, the increase in density, and the increase in carbon.

Q. What chemical changes took place during the decay process?

A. The cellulose of the vegetation and peat changed chemically into coal, plus methane, carbon dioxide, and carbon monoxide. Carbohydrates in the vegetation changed to hydrocarbons in the coal. The degree of change also depended on the decay resistance of the material, with lignin, bark, and spore and seed coverings being more resistant than the cellulose.

Q. What was the resultant difference in coal because of this difference in decay resistance?

A. The less resistant materials decomposed to form a jelly which hardened into dull, dense, fine-grained, fairly uniform coal. The more resistant materials formed bright coal with obvious cell structure. Because both types may be found in the same bed, they may appear as layers and are known as *banded coals*.

Q. How long ago did the formation of coal occur?

A. This process is still going on. Vegetation in bogs and marshes is still being transformed into peat, and peat is being transformed into coal. It has been estimated that it now takes approximately 100 years to form 1 ft of peat from a mass of vegetation. More of the coal now being mined in eastern U.S. is from vegetation of the Carboniferous Period (240 million years ago). Much of the western coal is from vegetation which grew in the Tertiary Period (7 to 55 million years ago), and lignites from the Quaternary Period (1 million years ago).

Q. Is coal a homogeneous material?

A. No. The chemistry of coal is extremely complex and coal varies from area to area, from mine to mine, and even from piece to piece.

Q. How are coal areas divided?

A. Coal areas have been designated in four classes by the U.S. Geological Survey: (1) districts, which are comparatively small and usually take their names from nearby townships; (2) fields, which are larger and may extend over a county or number of counties; (3) regions, which are groups of fields; and (4) provinces, which are extensive areas including several states. There are six provinces in the U.S.: Eastern (which extends from Maine and the Atlantic Coast to the middle of Kentucky and Georgia), Interior (the North Central states from western Kentucky to Iowa and from Michigan to northern Texas), Gulf (Alabama through parts of Texas and from the Gulf of Mexico to Arkansas), Northern Great Plains (parts of Wyoming, Montana, Colorado, and New Mexico), Rocky Mountain (the remainder of the mountain states), and Pacific Coast (California, Oregon, and Washington).

Q. Is there much difference between the coals of different provinces?

A. The Eastern and Interior provinces have most of the highest grade coal and the Eastern province produces almost all the "hard" coal. This is due in part to the fact that these coals were formed from the plants and fern trees of the Carboniferous Period, whereas coals of other areas were formed from hardwood and coniferous trees of later periods.

Q. In what ways does the composition of coal vary?

A. In amounts of volatile matter, fixed carbon, mineral matter or ash, sulfur, moisture, and cellular structure.

Q. What caused these differences?

A. Differences in composition are due to: (1) kind of vegetation from which the coal was formed; (2) type and duration of action by bacteria and fungi; (3) drainage conditions; (4) weight of overburden; (5) degree and duration of heat; and (6) movement of the earth's crust.

Q. What is banded coal?

A. Because of the different origins and the changes it has undergone in the transformation from vegetation, coal is not homogeneous. However, masses of fairly similar material may be seen in layers or bands. According to American terminology, these different masses may be anthraxylon, attritus, or fusain. *Anthraxylon* (wood coal) appears as a glossy,

coal vary? What does volatile matter consist of?

black band and is composed of the transformed remains of tree trunks, branches, and twigs. *Attritus*, the dull band material, is the result of transformation of leaves, spores, and bark. Attritus usually makes up the large mass in which anthraxylon may be embedded. *Fusain* consists of thin, dull, charcoallike pockets softer than the other two, present in very small amounts in the anthraxylon or attritus. Fusain is the least chemically active with the least volatile matter; next is attritus.

Q. What are vitrain, clarain, and durain?

A. In British practice, *vitrain* and *clarain* are approximately equivalent to anthraxylon or bright coal, while *durain* is equivalent to attritus or dull coal.

Q. What is meant by cannel, boghead, splint, and bright coal?

A. These are referred to as the petrographic types of coal. *Bright* coal has a predominating percentage of either anthraxylon or attritus; *splint* coal is of dull luster, consisting mostly of attritus; *semi-splint* has anthraxylon and attritus in approximately equal amounts; *cannel* and *boghead* coals are both almost all attritus, but cannel is due to the original existence of layers of spores, while boghead is due to oil algae.

Q. Of what does the volatile matter in coals consist? What does it indicate?

A. Volatile matter is that material, other than moisture, given off by coal when it is heated. It consists of methane and other hydrocarbons, hydrogen, oxygen, carbon monoxide, and carbon dioxide. The amount of volatile matter present is a measure of how far the change has progressed from carbohydrates in the original vegetation to hydrocarbons in the coal, the ease with which the coal will ignite, and the tendency of the coal to smoke.

Q. How is volatile matter in coal determined?

A. A sample of coal is heated in a container at a temperature of 1742 F under specified, standard conditions. The loss in weight, excluding moisture, is considered to be the amount of volatile matter which was present.

Q. At what temperatures does volatile matter distill off?

A. Water, carbon dioxide, and carbon monoxide—390 F; hydrogen sulfide—520 F; olefines higher than ethylene—570 F; ammonia and paraffin—660 F; hydrogen—1290 F.

Q. What are agglomerating and non-agglomerating coals?

A. An agglomerating coal is a caking coal. A non-agglomerating coal, on the other hand, is non-caking or free-burning. Actually, there is a slight difference between non-caking and free-burning: A non-caking coal will not fuse together when heated to the plastic state; a free-burning coal may fuse, but will then break apart. (In this article, the term free-burning will be used.) Caking is the tendency of coal to fuse together in the plastic state.

Q. What is the difference in combustion between free-burning and caking coals?

A. The passage of air is not restricted much during the combustion of free-burning coal and may proceed at a uniform rate over the entire bed. Because caking coals will fuse in larger masses, certain parts of which may not receive air sufficient for combustion and certain parts of which obtain excessive amounts, they have a tendency to burn unevenly unless used with stokers which break up the masses.

Q. Is there a difference between coking and caking of coal?

A. Coking is the process wherein coal is heated with little or no contact with air and the volatile matter is driven off. Coking of coal may take place in a furnace where, because of a temporary lack of air, the volatile matter is driven off. The remaining coke later burns to a mixture of carbon dioxide and carbon monoxide when air does become available. Coking in an oven consists of burning a small part of the coal charge to provide heat to drive off the volatile matter in the remainder to form coke which is then withdrawn for use elsewhere. As mentioned previously, caking is the tendency of coal, or coke, to fuse together.

Q. Are caking coals always good coking coals and vice versa?

A. In a furnace, the formation of coke is a step in the combustion of coal, not an end product. Good coking coals are therefore necessary only for production of coke in ovens. Some caking coals do not make good coke, while some free-burning ones do. Generally, however, it is required that a good coking coal have caking tendencies in order that the resultant product be of such size that it can be properly used in metallurgical and other processes.

Q. Of what does ash consist?

A. Ash is the incombustible residue left after coal is compeletely burned and consists of materials such as silica, iron, lime, alumina, titanium, magnesia, and other elements. It is usually less in weight than the mineral matter originally present in coal because of chemical changes during combustion.

Q. Is there any relationship between the weights of ash and mineral matter?

A. One of the relationships which has been proposed is: mineral matter = 1.08 × ash + 0.55 × sulfur. Another is: mineral matter = 1.1 × ash + 0.1 × sulfur. Generally, ash is about 15 percent less than the mineral matter in the original coal.

Q. How did the mineral matter get into the coal?

A. Some of the mineral matter may have been present in the original vegetation which accumulated and decomposed to form coal; a great deal of it may have been sand and silt deposited by sedimentation; or debris from neighboring rock may have been included during mining.

Q. What is meant by "bone" in relation to coal?

A. Layers of coal in mines alternate with layers of noncarbon material present as rock. Sometimes a layer may have a composition intermediate between that of the coal and that of the rock. This material is known as *bone*.

Q. Can the mineral matter from debris be removed from coal during processing?

A. It can be removed to a great extent by washing. In this way, a large amount of debris from mines which would show up as mineral matter and ash is removed with only a slight loss of coal itself.

Q. Is there any difference between the terms "ash" and "ashes"?

A. Ash refers to the incombustible material left after coal is burned; *ashes* refers to the refuse which is removed from a furnace after combustion and which may still contain combustible materials.

Q. Why is a high percentage of mineral matter in coal undesirable?

A. A great deal of inert material is being handled, transported, and stored, thereby increasing costs. If mineral matter is too great, the ash may affect combustion by blocking passage of air and gas through grates and the fuel bed. Ash must be disposed of, generally at considerable expense. Large amounts of ash in a fuel bed are more liable to form clinkers. Ash deposits on furnace walls and boiler tubes reduce combustion efficiency and increase maintenance costs.

Q. What is ash-softening temperature? How is it determined?

A. As the temperature of ash is raised in a furnace, it becomes soft and then liquid. The temperature at which it first becomes soft and plastic is known as the ash-softening or fusion temperature. As the temperature increases, the ash enters a liquid phase at the fluid temperature. To determine these temperatures, a small cone of ash made with an organic binder is placed in a laboratory furnace in which the temperature is then raised. After a while, the top of the cone will blunt or bend. This is the initial deformation temperature. As the ash gets more plastic, it will form a semi-spheroidal lump at the softening temperature. When the ash flattens out completely, it has reached the fluid temperature (See ASTM D271-58).

Q. Why is knowledge of ash softening temperature important?

A. During the period when ash is soft or liquid, it is sticky and causes clinker trouble in the fuel beds and deposits of slag on furnace walls and boiler tubes. Conversely, in furnaces where ash is removed by being melted and then drained off as a liquid, a very high ash fusion temperature may result in operational problems.

Q. What are slagging and spalling?

A. Slagging is the accumulation of softened or melted ash on furnace walls or boiler tubes. Spalling is cracking or breaking away of the outer surface of brick in a furnace, usually caused by accumulations of heavy amounts of slag.

Q. At what range of temperature will ash soften?

A. Ash softening temperature varies from 1900 F to slightly over 3100 F. Ash has been divided into three classes of fusibility: Class I, refractory ash which softens at temperatures above 2600 F; Class II, medium fusibility ash which softens between 2200 and 2600 F; and Class III, easily fusible ash which softens below 2200 F.

Q. Do certain constituents of ash cause lower softening temperatures than others?

A. Ash with large amounts of silica and/or alumina have high softening temperatures. Presence of iron sulfide or oxide has a tendency to lower the softening temperature.

More questions and answers on coal will be presented in an early issue. ∓

HOW TEMPERATURE, TREATMENT, AND VELOCITY OF POTABLE WATER AFFECT CORROSION OF COPPER AND ITS ALLOYS

Different Softened Waters Have Broad Corrosive Effects on Copper Tubing

• Tests conducted at Michigan State University are shedding new light on the effects of various temperatures, qualities, and velocities of potable water on the corrosion of copper and copper alloy tubing. Jointly sponsored by MSU and the corrosion committee of the Copper and Brass Research Association, the program included studies of the effects of dissolved gases in the water and of different methods of water treatment. In comparing the results of tests with deaerated sodium-zeolite softened water with those of nondeaerated sodium-zeolite softened water, it was noted that:

1) More corrosion occurs when nondeaerated water is used. It is about 50 percent greater for the higher temperatures (170 and 200 F) and velocities (8.1 and 13.1 fps).

2) High temperature pitting of copper tubes is greatly reduced at 170 and 200 F if deaeration is utilized.

3) Cold vacuum deaeration appears to be a reasonable solution for reducing corrosion by aggressive, gasified, sodium-zeolite softened waters.

In reviewing the results with lime-soda softened water, it was found that:

1) The water should be stabilized after filtration and carbonization before being used in a distribution system. Results from this study were inconclusive, since too much precipitation of calcium salts was occurring in the panel and connecting tubes.

2) No real differences were noted in the behavior of lime-soda softened water followed by sodium-zeolite softening over that of straight lime-soda softened water.

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WHENEVER corrosion in water distribution systems is considered, the nature of the water composition is always extensively discussed. Of the various factors involved, the presence of dissolved gases in the water and the methods of water treatment are important.

Since the presence of dissolved oxygen and carbon dioxide greatly increases the aggressiveness of a water, several methods of controlling the concentrations of these dissolved gases have been explored. One of these methods was room temperature vacuum deaeration, for which the results are herein reported.

In the first part of this article, the results obtained using room temperature vacuum deaerated water to reduce the aggressiveness of sodium zeolite water on the corrosion of copper will be discussed. In the second section, the studies of the effects using lime-soda softened, and lime-soda softened by sodium zeolite softened water on copper will be summarized.

Water exposed to the atmosphere dissolves oxygen, nitrogen, carbon dioxide, and other gases to a point of saturation. This saturation point depends upon the temperature and pressure of the system. The amount of gases dissolved by the water is also influenced by other constituents dissolved in the water. For instance, distilled water absorbs more oxygen at a given temperature than does water at the same temperature containing dissolved materials.

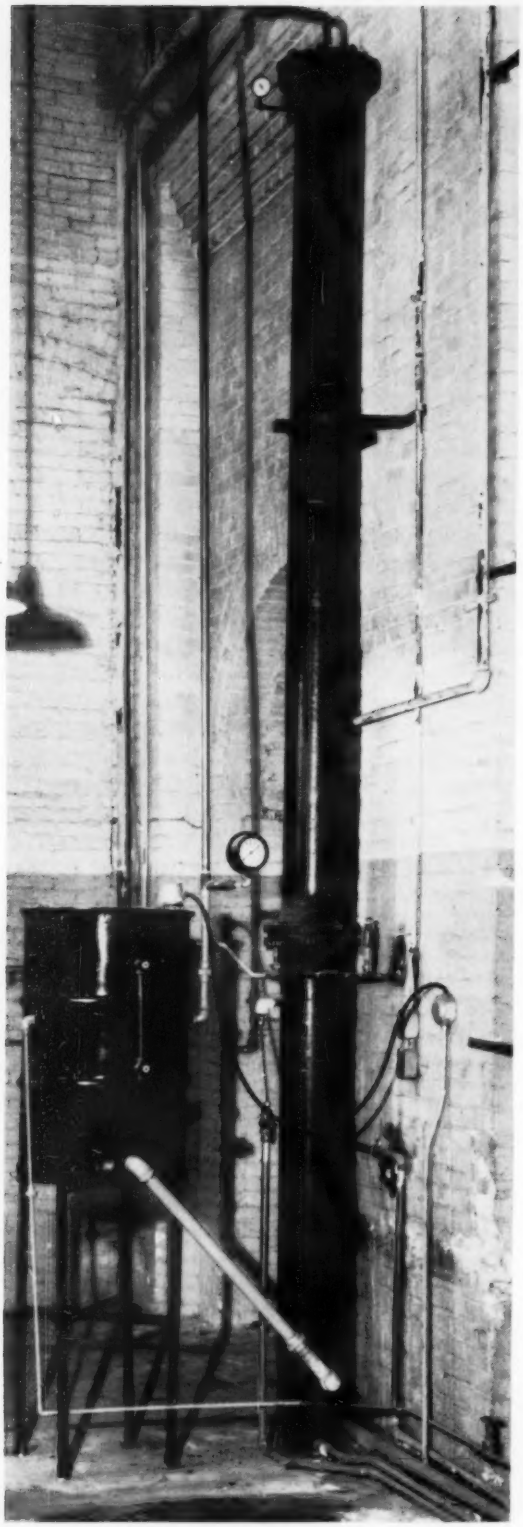
From Graph 1 it can be seen that the rate and amount of corrosion can be closely correlated with the concentration of oxygen in the water. The data are the results of closed-system static corrosion tests run at 140 F with high-purity copper and water initially containing 1.48 ppm dissolved oxygen.

Additional laboratory testing corroborates the statements made concerning the increase in rate of corrosion when both CO_2 and oxygen are present. Graph 2 represents the results of closed-system static corrosion tests at 140 F with high purity copper and water containing 70 ppm dissolved carbon dioxide.

These graphs indicate the importance of removing dissolved gases from solution if significant progress is to be made in decreasing the amount and severity of corrosion in water distribution systems. The important dissolved gases are oxygen, carbon dioxide, and hydrogen sulfide. Deaeration of water can be brought about by mechanical or thermal treatment, by the addition of chemicals, or by a combination of these processes.

Room temperature vacuum deaeration seems to offer the most feasible method for degasification of

This is the fifth in a series of articles. The first four appeared in the January, March, April, and May issues.



1 COLD VACUUM DEAERATOR pilot unit shown above was used for MTP No. 5. Water temperatures through panel were 50, 80, 110, 140, 170, 200 F

potable service water. Deaeration of cold water is accomplished by dividing the water into small particles to lower liquid phase resistance and thus facilitate gas removal. On the deaerator, a vacuum should be maintained which corresponds to the boiling pressure for the water temperature involved. For this study, a vacuum of 26 in. Hg was maintained, corresponding to a boiling temperature of approximately 125 F.

In designing a vacuum deaerator, several factors are considered:

1) Specified residual gas concentration to be maintained in the deaerated water

2) Physical characteristics of the collection and distribution system

3) Economics involved in such facilities.

In a typical unit the feedwater enters near the top of the unit through a spray nozzle or other mechanical device which spreads the water evenly over the cross-section of the tower. The water then falls through packing which tends to keep it divided into fine particles, thereby facilitating diffusion of the gases out of it. Gases and water vapor released from the water are removed from the deaerator by the vacuum. The vapor line of the system should be baffled to minimize carryover of liquid into the vacuum producing device. Either a steam jet ejector or a vacuum pump can be used to create the vacuum. Design of an efficient deaeration unit provides for:

1) Maintaining a sufficiently low liquid flow rate (in terms of gallons per square foot of cross-sectional area) to prevent flooding the packing

2) Packing in sufficient depth for equilibrium to be reached or closely approximated

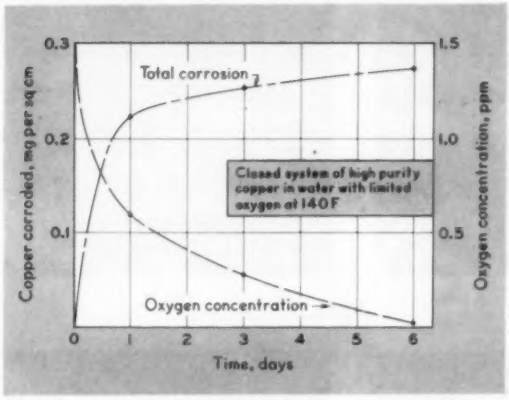
3) Arranging and spacing the packing to effect good distribution and to prevent channeling

4) Pipelines of adequate size to remove gases and vapors with minimum pressure drop.

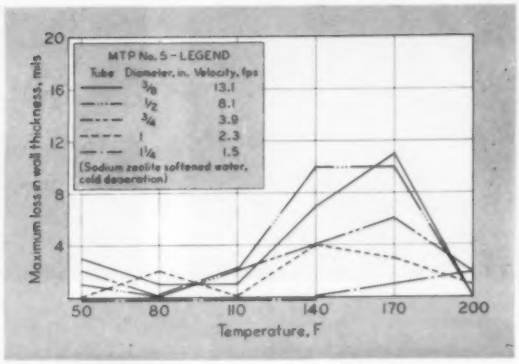
Since it is not practical to remove all residual dissolved gases from the cold water, preliminary investigations must be made to determine minimum gas concentrations for a particular application. If necessary, to reach extremely low gas concentrations, multistage units can be employed.

To provide data for operation within a useful range of gas concentrations, a test panel to test the effect of vacuum deaerated water on copper tubing was set up at Michigan State University. The panel, designated as Main Test Panel No. 5, is similar to those described in the earlier articles in this series. A cold water vacuum deaerator was built specifically for this test panel.

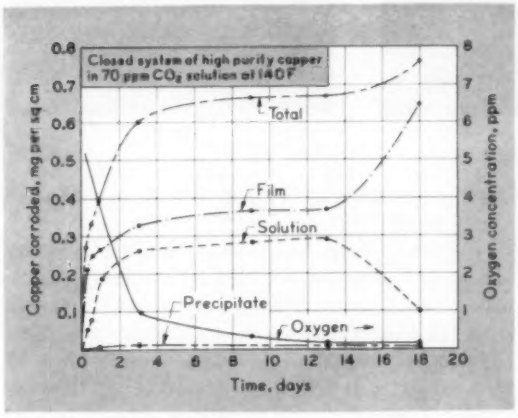
The deaerator system consists of a steel shell, 17 ft long, with an outside diameter of 8 in. Water is fed into the top of the deaerator through a spray nozzle. Directly below this nozzle is an 8-ft section packed with ½ in. Raschig rings. The vacuum line is tapped in just below the packed section. A vacuum of approximately 26 in. Hg for the unit is supplied by the turbine condensor of a powerhouse turbine.


Total corrosion
Closed system of high purity copper in water with limited oxygen at 140 F
Oxygen concentration
Copper corroded, mg per sq cm
Oxygen concentration, ppm
Time, days

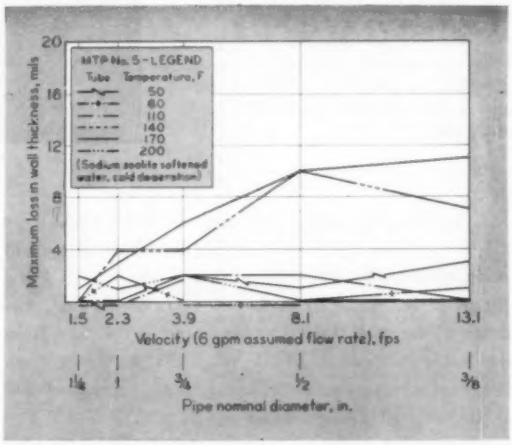
GRAPH 1—RATE, AMOUNT of corrosion is closely correlated with oxygen concentration in water



GRAPH 3—TEMPERATURE *vs* maximum loss of wall thickness for MTP No. 5 shown here



GRAPH 2—CORROSION of copper in 70 ppm CO_2 solution and 5 ppm oxygen high purity water plotted above



GRAPH 4—VELOCITY had these effects on loss in wall thickness of copper tube in MTP No. 5

The electrodes of an automatic cutoff switch are also installed in the collection drum. This switch will stop the pump connected to the deaerator outlet whenever the water level drops below a fixed point in the column. This control is necessary to prevent pump damage in the event the column runs dry. The complete deaerator unit is pictured in Fig. 1.

The test panel connected to the deaerator, identical in construction to MTP No. 1, was operated under temperature and flow conditions identical to those used in MTP No. 1. The rate of flow through the panel was 6 gpm of water and the temperatures of the six passes of the panel were 50, 80, 110, 140, 170, and 200 F, respectively.

Circulation of the sodium zeolite softened water from the deaerator through the panel is maintained by a centrifugal pump. The piping is arranged so that the flow through the panel can be regulated quite accurately. The float level control of the column automatically adjusts the amount of feedwater to equal the amount of water withdrawn.

The feedwater to the deaerator was sodium zeolite softened water obtained from the power plant water supply. Since this is the same water used in MTP No. 1, a comparison of the effects of deaerated and non-deaerated waters on the copper tube is possible.

Both test panels were on stream for 498 days with periodic shutdowns about every four months to examine, with a boroscope, the inside tube walls of each test loop.

The oxygen content of the incoming water used in MTP No. 5 varied from 6 to 12 ppm, as determined by laboratory analysis. This range of concentrations may seem very large, but in light of the fact that this data covers both summer and winter months, this variance should be expected. The carbon dioxide content varied up to 40 ppm over this same period.

The deaeration process lowered the concentrations of these gases to 1 to 2 ppm CO_2 and 5 to 6.5 ppm CO_2 corresponding to a removal of approximately 60 to 80 percent of the oxygen and 80 percent of the carbon dioxide.

Fig. 2

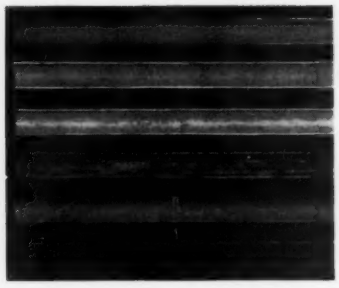


Fig. 3

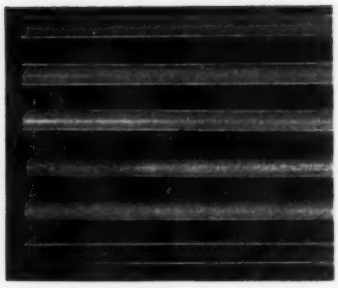


Fig. 4

2-6 THESE COPPER TUBE sections were subjected to the following operating conditions: Fig. 2, ¾ in., with varying temperatures at 3.9 fps; Fig. 3, ½ in., varying temperatures at 8.1 fps; Fig. 4, ⅜ in., varying temperatures at 13.1 fps; Fig. 5, varying velocities at 110 F; Fig. 6, varying velocities at 140 F. All handled sodium zeolite softened water with cold deaeration

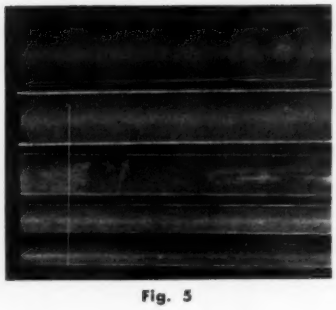


Fig. 5

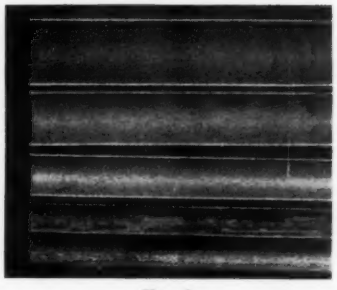


Fig. 6

After the 498 days' operation, the two panels were dismantled and the tube sectioned for observation and evaluation of the extent of corrosion. As expected, the corrosion in MTP No. 1, the nondeaerated panel, was more severe than the corrosion found in the tube from the deaerated panel, MTP No. 5. From pointed micrometer measurements of the pits, it was found that at the higher temperatures (170 and 200 F) and velocities (8.1 and 13.1 fps) the maximum loss in wall thickness was as much as 50 percent greater in MTP No. 1 than in MTP No. 5. At lower temperatures and velocities, the differences in the maximum loss were less, but they were still appreciable. Graphs 3 and 4 represent the maximum loss in wall thickness as a function of the temperature and velocity for MTP No. 5.

Note from these graphs that mechanical degasification in this case has reduced the corrosiveness of the sodium zeolite softened water, thereby extending the useful life of the tube used. The effect of increased velocity from 3.9 fps to 8.1 fps and 13.1 fps on the corrosiveness of deaerated sodium zeolite softened water is illustrated in Figs. 2, 3, and 4. Corrosion of copper increased at velocities greater than 4 fps. However, the increase in corrosion rate is not as rapid as with nondeaerated sodium zeolite softened water (see the article, *Tests Show Effects of Water Quality at Various Temperatures, Velocities*, in the May issue).

The less critical nature of increased temperature on corrosion of copper by sodium zeolite softened water when deaerated in the temperature range of 110 to 140 F is clearly illustrated in Figs. 5 and 6. The reduction of high temperature pitting by deaeration is quite pronounced at 170 and 200 F, as shown in Figs. 7 and 8.

In general, it can be concluded that the reduction of oxygen and carbon dioxide gas from an aggressive sodium zeolite softened water by cold vacuum deaeration has a marked reduction on corrosion rate. This reduction of corrosion rate is over a wide range of temperatures and velocities. Corrosion still may be serious in the 140 to 170 F range if velocity exceeds 5 fps. Cold vacuum deaeration offers a reasonable solution for reducing corrosion of an aggressive gasified sodium zeolite softened water.

Another phase of the corrosion studies at Michigan State was to observe the effects of lime-soda softened water on the corrosion of copper tube in water distribution systems. To remove "hardness" from cold potable water, two extensively used processes are the *ion exchange* and the *lime-soda* methods. Several variations of the two schemes are utilized in special cases. The ion exchange process has already been mentioned in reference to sodium zeolite softened water. In the second method, substances which cause the hardness are removed by precipitation with appropriate chemicals followed by filtration and/or settling. This general process and its variations are designated as the *lime-soda* process.

In this process, the substances which cause "temporary hardness," namely the soluble calcium and magnesium bicarbonates, are precipitated by lime, CaO, added in proper amount. The calcium oxide is an efficient inexpensive chemical for attaining, in water, the alkalinity necessary to cause precipitation. The materials causing "permanent hardness," name-

TABLE 1—FOR MAIN TEST PANEL No. 5, handling deaerated sodium zeolite softened water revealed these observations under binocular microscopic examination

Temperature, F	Velocity, fps	Tube diameter, in.	Observation of deposits and surfaces
50	1.5	1¼	Covered with dark brown film; large cathodic areas of "olive drab" and brown colors; brown areas are definite deposit buildup; olive colored areas seem to be more like a film over the original brown film; No visible velocity effects.
	2.3	1	Same general appearance as ⅜ in.; small cathodic islands, etc.; also has slight variations in film color, i.e., from dark brown to a dark green-brown; shiny material generally visible through film; velocity effects not visible; one isolated pit with anodic area within pit leaving exposed metal.
	3.9	¾	Covered with brown film; shiny material visible through film; large area covered with light brown deposit on exit end of tube; no visible velocity effects, some smaller groups of cathodic areas upstream; appears to be generally spotted with anodic areas; some kind of greasy substance seems to have dropped onto exit end into deposit area; there seems to be an anodic area beneath this grease.
	8.1	½	Same as ⅜ in., except no buildup of deposits at downstream end.
	13.1	⅜	Dark brown film covering entire surface; several groups of small cathodic islands; velocity effects visible and covered with film; greenish brown deposit buildup over film; small anodic areas downstream from deposits; some deposits seem to have been fractured leaving anodic area visible; definite undercutting visible.
80	1.5	1¼	Large areas of light brown film over background of reddish-brown film; some areas of buildup of darker deposit; no visible anodic areas; no visible flow indication.
	2.3	1	Dark brown film covers all surface area; small isolated cathodic islands scattered over surface; band of reddish-brown deposit at exit end; lighter brown color seems to be undercoat of other deposit; no velocity effects visible; small anodic pits scattered throughout area covered with film.
	3.9	¾	General film covering surface; no velocity effects visible; small islands covered with brown deposits sometimes speckled with some green colored material; some small bright areas adjacent to islands; places where deposits seem to have broken off are definitely anodic; general brightness visible through film (moreso than two previous pieces).
	8.1	½	Cathodic islands are grouped but spotted; islands are very small and covered with brown deposit; greatest concentration of islands is on downstream end of tube; velocity effects are also more clearly visible there; horseshoe pits generallly covered with film; anodic areas immediately downstream of deposits (islands); some pits visible with anodic area at bottom of pit.
	13.1	⅜	Very difinite velocity effects over entire surface area; general stratification of cathodic islands; also separate islands arranged in rows; undercutting and pitting very evident along irregular "coastline" of islands; anodic areas are intermingled between the islands; individual islands have anodic area directly downstream; further downstream, surface film (dark brown) is evident; some islands seems to have had the deposits removed, thus revealing anodic areas; other islands within horseshoe pits have no deposits, but are covered with dark brown film.
Note: All deposits in this 80 F. group have green crusts on top			
100	1.5	1¼	General reddish film; some islands are also covered with this film; other islands are usual brown, some topped with green color; film is speckled with small grey-blue areas.
	2.3	1	Surface appears to be somewhat rough; small cathodic islands scattered (widely) over surface; areas directly downstream of islands are grey-green in color (seem to be protected); no flow indication visible.
	3.9	¾	Large band of brown deposit at downstream end; strip also running length of tube; direction of flow visible only in some places; anodic pits occurring within protected areas.
	8.1	½	Has same copper colored film a little less shiny; direction of flow still indicated although not as pronounced; islands are still generally aligned, but there are also many of them just scattered throughout surface; larger islands are at downstream end.
	13.1	⅜	Stratified islands of brown deposits; some of the islands are small individual ones, but are strung out in a line; direction of flow indicated by horseshoe pits; surface is bright metal colored, but seems to be a thin film; in some of the islands the brown deposit is gone and the remains have a green tint to them; two or three places are actually blue; isolated pits have a blue tint to them.
140	1.5	1¼	Same as ⅜ in.; film not quite as shiny as ¾ in. sample; one area covered with islands of almost perfect geometric figures, i.e., circles and ellipses.
	2.3	1	Same as ¾ in.; islands generally a little larger; film more reddish colored than ¾ in.
	3.9	¾	General copper color bright background; small cathodic islands, some covered with brown deposit, others with general surface film; larger island at downstream and partially covered with brown deposit, remainder greenish-copper colored material; general green speckling visible over entire surface; definite area of green film surrounding all islands.
	8.1	½	Large area covered with brown deposit; uncovered area pitted; only small islands of deposits near exit end; small isolated anodic pits in large cathodic areas; direction of flow indicated in places by horseshoe pits; undercutting of deposit visible.
	13.1	⅜	Surface badly pitted; small cathodic islands, generally aligned along direction of flow; undercutting of islands visible.
170	1.5	1¼	Very dark film going from dark green at entrance through a band which is almost black, then back to green, tan all the way to reddish color found in 1 in. section; entrance end seems to be very porous with small pits in the deposit showing the red film beneath; downstream end seems more solid, but thins out considerably showing larger patches of red; no visible pitting.
	2.3	1	Reddish film speckled with dark green cathodic areas fringed generally with bright material (anodic areas).
	3.9	¾	General pitting over entire surface; some very large pits distributed at random throughout; some very small cathodic islands on downstream end; brown film on inside of horseshoe pits.
	8.1	½	Same as ⅜ in. except there is a strip which is only very slightly pitted extending almost total length of tube (becoming more pitted at downstream end).
	13.1	⅜	General pitting throughout surface area; some unusually deeper pits, usually two or three pits aligned in the direction of flow; small cathodic islands widely dispersed over surface.
200	1.5	1¼	No visible attack.
	2.3	1	Same
	3.9	¾	Same
	8.1	½	Slight pitting.
	13.1	⅜	Pitting and velocity effects visible.
Note: All tubing in this 200 F group is covered with black film.			

ly calcium and magnesium salts other than the bicarbonates, are precipitated by addition of an appropriate amount of soda ash.

This method for decreasing the hardness of waters is employed for large domestic and industrial uses. When carried out on raw waters at normal tempera-

Fig. 7

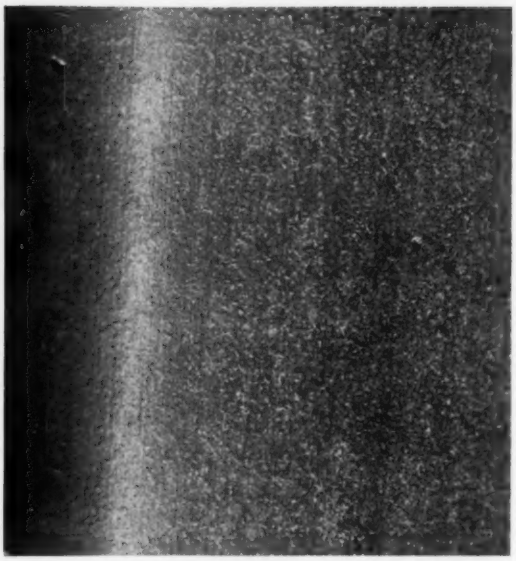


Fig. 8

7-8 COPPER TUBE SECTIONS (chemically cleaned) show temperature effect. Fig. 7 handled water at 170 F; Fig. 8, at 200 F. Water velocity through both was 2.3 fps

tures, it is referred to as the cold lime-soda process. Important factors involved in the process are:

1) Correctly proportioning the specific chemicals being added to the water

2) Propagating the chemical precipitation reactions by a suitable combination of coagulants, sediment action, and sludge contact

3) Filtering the chemically softened water to remove turbidity or suspended matter resulting from the process

4) Stabilizing the effluent water

5) Maintaining potability of the water by appropriate controlling of the pH.

Cold lime soda softening reduces the hardness to approximately 20 to 60 ppm of calcium carbonate hardness, depending on the temperature of operation and the alkalinity maintained on the softener effluent. This type of softened water is not suitable for use in boilers or heat exchangers, but it is for domestic and certain industrial applications.

TABLE 2—ANALYSES of raw water and effluent after removal from pilot plant cold process lime-soda reactor and after recarbonization are given below

Constituent in water	Parts per million as $CaCO_3$		
	Raw water	Effluent lime-soda reactor	Effluent recarbonization unit
Calcium	210	35	35
Magnesium	123	50	50
Sodium	1	1	1
Bicarbonate	313	0	39
Carbonate	0	36	16
Hydroxide	0	19	0
Sulfate	16	26	26
Chlorides	5	5	5
Carbon dioxide	40	0	0
Total hardness	333	85	85
Methyl orange alkalinity	313	55	55
pH	7.2	10.2	9.3

In the lime-soda process, several chemical reactions are involved in the regulation of the amounts of calcium, magnesium and other ions, and the degree of alkalinity necessary to cause softening. First, any free carbon dioxide present in the water consumes lime and produces calcium bicarbonate to increase the hardness originally present in the water according to the reaction:

$$2CO_2 + Ca(OH)_2 \rightleftharpoons Ca(HCO_3)_2 \quad \ldots\ldots (1)$$

Next, the important reaction for converting soluble calcium bicarbonate to the relatively insoluble normal carbonate takes place:

$$Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3\downarrow + 2H_2O \quad \ldots\ldots (2)$$

These two reactions are brought about by adding sufficient lime. Although some calcium carbonate remains in solution, the bulk of it precipitates and is removed by settling and filtering.

If magnesium or sodium bicarbonates are present, the lime consumption for complete treatment will be increased because of the reactions:

$$Mg(HCO_3)_2 + Ca(OH)_2 \rightarrow MgCO_3 + CaCO_3\downarrow + 2H_2O \quad \ldots\ldots (3)$$

$$2NaHCO_3 + Ca(OH)_2 \rightarrow Na_2CO_3 + CaCO_3\downarrow + 2H_2O \quad \ldots\ldots (4)$$

Since the sodium and magnesium carbonates formed are soluble, the additional lime used to react with the magnesium and sodium bicarbonates does not directly remove an equivalent amount of hardness. However, the soluble carbonates formed *do* improve the performance of the process. This increase in performance is due to the reduction of magnesium hardness by precipitating magnesium hydroxide to remove the magnesium carbonate formed, as well as any magnesium sulfate or chloride present in the raw water, as indicated by these reactions:

$$MgCO_3 + Ca(OH)_2 \rightarrow Mg(OH)_2\downarrow + CaCO_3 \quad (5)$$
$$MgSO_4 + Ca(OH)_2 \rightarrow Mg(OH)_2\downarrow + CaSO_4 \quad (6)$$
$$MgCl_2 + Ca(OH)_2 \rightarrow Mg(OH)_2\downarrow + CaCl_2 \quad (7)$$

The last group of important reactions in the lime-soda softening process converts soluble calcium sulfate and chloride to the insoluble calcium carbonate with soda ash.

$$CaSO_4 + Na_2CO_3 \rightarrow CaCO_3\downarrow + Na_2SO_4 \quad (8)$$
$$CaCl_2 + Na_2CO_3 \rightarrow CaCO_3\downarrow + 2NaCl \quad (9)$$

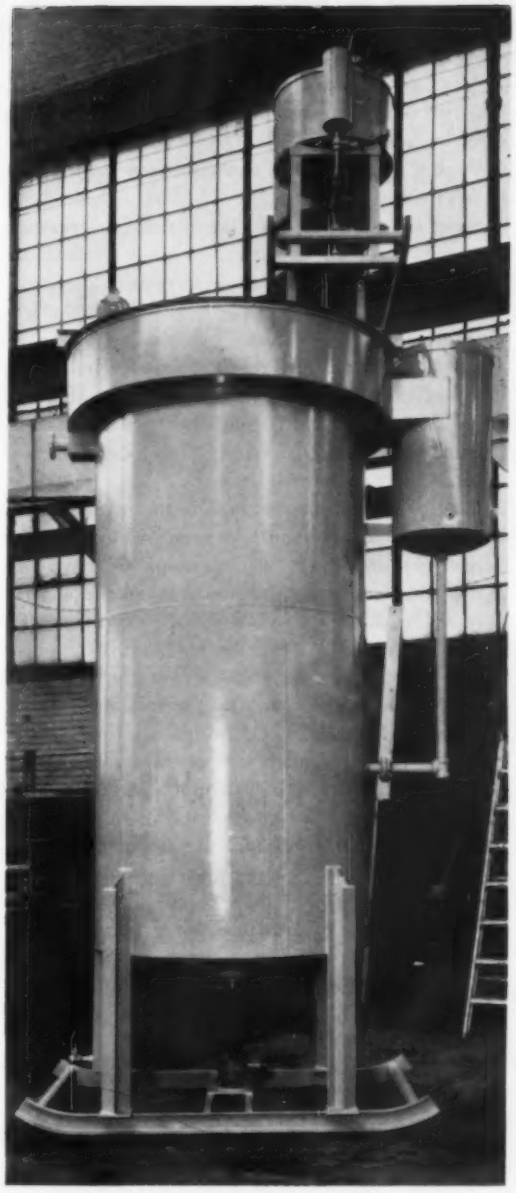
The calcium carbonate, thus formed, is removed along with the carbonate precipitated in the calcium bicarbonate reactions. The soda ash added reduces the hardness due to noncarbonate calcium and noncarbonate magnesium, i.e., permanent hardness.

The effluent from the lime-soda process is not stable, but is saturated with calcium carbonate. Increasing the temperature of the water causes deposition of calcium carbonate on the filter and in the distribution lines, due to the inverse solubility of the calcium carbonate. To counteract this difficulty of recarbonization, carbon dioxide gas is used to stabilize and prevent precipitation of the calcium carbonate from lime-soda softened water. The reactions involved in recarbonization are:

$$Ca(OH)_2 + CO_2 \rightarrow CaCO_3\downarrow + H_2O \quad (10)$$
$$CaCO_3 + CO_2 \rightarrow H_2O + Ca(HCO_3)_2 \quad (11)$$
$$Mg(OH)_2 + 2CO_2 \rightarrow Mg(HCO_3)_2 \quad (12)$$

In practice, an excess of lime is added to force the softening reactions to produce a usable soft water which results in an excessive caustic alkalinity in the softener effluent. In the recarbonization step, the excess lime is neutralized by the carbon dioxide to produce a "stabilized" potable water. Ordinarily, at the time of recarbonization, the water is saturated with both calcium carbonate and magnesium hydroxide, causing a tendency for scale formation if the water were not stabilized by the recarbonization — especially if the temperature of the water is subsequently raised. The added carbon dioxide tends to convert these substances to more soluble salts, thereby reducing their tendency to precipitate. In large industrial systems, stabilization can be obtained by appropriate blending of raw water and the effluent from the lime-soda reactors.

The MSU lime-soda pilot plant study utilized a commercial pilot plant cold process lime-soda reactor with units for three chemical feeds. See Fig. 1. The reactor had a softening capacity of 20 gpm, but was operated at a rate of 12 gpm. In operating the unit, the inlet water was first mixed with an alum coagulant. The solution of coagulant and water was introduced near the bottom of the reaction chamber where it was mixed with the cold lime slurry. Calcium carbonate was thus formed and precipitated. The coagulant was necessary to flocculate the calcium carbonate precipitate to avoid carrying it over into the outlet water stream.



9 LIME-SODA PILOT PLANT REACTOR shown above was used for softening water for MTP Nos. 3 and 4

The insoluble calcium carbonate settled to the bottom of the reactor and was drawn off as a thick sludge; the treated water was drawn off at the top of the reaction chamber. The effluent was then recarbonized to adjust the pH to the designated level. The effluent from the lime softener contained a composite hardness of 85 ppm, 36 ppm CO_3, and 19 ppm OH. After recarbonization with CO_2, the desired composition was to be 85 ppm hardness, 39 ppm HCO_3, and 16 ppm CO_3. The stabilization was accomplished by bubbling CO_2 gas into the outlet

stream from the reactor. A gas flow meter and a needle regulating valve in the CO_2 feed line permitted adjustment of the feed rate to the desired level.

After recarbonization, the effluent was divided into two equal streams of 6 gpm. One stream went directly to MTP No. 3. The other stream passed through a sodium zeolite water softener before going to MTP No. 4.

Soon after the reactor was placed in operation, numerous mechanical difficulties were encountered; considerable time and effort were required before its operation became fairly stable and dependable. During this time, the effluent was discharged to the drain. Control tests of the softened water and operating conditions were varied in an effort to obtain an effluent of the desired composition. It was found not possible to consistently maintain the operating variables within very narrow limits.

Most of the hardness present in the raw water was temporary hardness and was removed by the addition of the lime. Soda ash, necessary to remove the permanent hardness, was added to the system as required by mixing it with the lime slurry. Operation of the reactor was quite routine and required the service of one man for about 3 hours a day, which included time of regenerating the two zeolite water softeners used in parallel. Additional time was required to run the control tests on the softened water. Reactor operation required careful attention to maintain the necessary continuous operation. Any interruption broke the continuity of the panel tests.

The following procedures were used to obtain the chemical and physical data from the cold process lime-soda reactor system and test panels.

1) Recording temperatures and flow rates daily
2) Recording daily the raw water composition
3) Recording daily the amounts of lime, soda ash and alum, and CO_2 used
4) Analyzing chemically the raw, effluent, recarbonated, and zeolite softened waters each shift
5) Checking lime, alum, and CO_2 feed rates daily
6) Analyzing the water from all panels weekly.

Although the lime-soda pilot plant was operated according to the specifications, excessive deposits caused plugging of the main corrosion test panels. This condition was first noted when a high pressure drop was found at a point where effluent passed through the zeolite softeners. It became apparent that the zeolites were acting as filters and that stabilization of the water by the CO_2 feed had not been achieved. It was then decided to install a filter to provide filtration of carryover and allow more carbonization time for effluent stabilization.

During the inspection of the test panels by the Copper and Brass Research Association it was found that both panels MTP Nos. 3 and 4 were so heavily coated with deposit that observation of the tube surfaces was impossible. It was decided to remove the excess deposit by chemical cleaning. This was done by circulating alternately, inhibited hydrochloric acid and cold water through the two test panels. A similar deposit was found on and removed from the zeolite mineral of the two softeners.

Throughout the operation of the reactor, difficulties were encountered in regulating and maintaining the lime feed with the pumps, which seemed unable to maintain a steady flow at a 20 ft head. It was then decided that a more satisfactory water might be obtained if the sludge were recirculated and the scraper in the bottom of the reactor were turned. While making these adjustments it was observed that feeding the lime and alum into the sludge recirculation tank not only placed all the chemicals in the reactor simultaneously, but also relieved the load on the pumps. The recirculation tank was provided with a system of floats to regulate the water flow into the tank and activate the pump to provide for automatic recirculation of the sludge as well as the treatment chemicals.

This operation proved unsatisfactory and was discontinued due to the rapid buildup of deposit in the recirculation lines and the pumps.

Finally, it was decided that a more nearly constant lime flow might be obtained by feeding from a reservoir above the level of the reactor and employing a Sigma motor as a metering device only. To permit this gravity flow, a 55 gal drum was installed on the operating floor; it was filled as necessary from the regular 200 gal mixing tank, by a sludge pump.

At the same time, the alum flow was erratic and it was decided to also feed it by gravity. Another 55 gal drum was installed on the operating floor from which the alum solution was allowed to flow dropwise into the reactor.

The test panels were disassembled several times during the period of operation of the lime-soda softener for inspection by the CABRA corrosion committee. After completing the tests on the lime-soda softened water, tubing from MTP No. 3 was removed and the tubing from MTP No. 4 was used over in another panel, i.e., MTP No. 3A for testing blended water. Both MTP Nos. 3 and 4 ran for 324 days before being shut down.

The pilot plant never did produce stable water. In fact, design conditions could not be attained. To increase stability of the water, the hardness was allowed to run higher than indicated in the design.

One major difficulty arising from using a higher hardness than planned was the inability to maintain desired temperatures in the higher temperature loops of the panel due to excessive scale deposits.

Although part of the lime-soda softened water was followed by sodium zeolite softening, no significant variations were observed in MTP No. 4 over the corrosion noted in MTP No. 3, which had straight lime-soda softened water flowing through it. ∓

How to Determine Air Flow Through Half-Cylinder Exhaust Hoods

By CLYDE F. METZLER
Chief Engineer
National Technical and Scientific Co.

THE HALF-CYLINDER exhaust hood is popular for a number of applications. How much air will pass through an exhaust hood of this design? The nomograph on the next page lets you compute this with a minimum of time and effort.

If you know the hood dimensions and air velocity, simply draw a straight line connecting the dimensions, draw another line from the point that this intersects the pivot to the air velocity, and read the exhaust flow on this line at the point it intersects the exhaust flow scale. Here are two examples:

Example 1:

Problem: What is the exhaust flow through a half-cylinder hood if $X = 6$ ft, $L = 30$ ft, and the air velocity = 50 fpm?

Solution: Enter the chart on the left at $X = 6$ ft and draw a straight line (1) to $L = 30$ ft on the right. From the intersection with the pivot, draw another straight line (2) through the air velocity of 50 fpm on the left. At the intersection with the central scale, read the air flow as 28,000 cfm.

Example 2:

Problem: A plating tank hood has a length of 25 ft and a width of 4 ft. What is the air quantity exhausted with an air velocity of 75 fpm?

Solution: Enter the chart on the left at $X = W/2 = 4/2 = 2$ ft and draw a straight line through $L = 25$ ft on the right. From the pivot intersection, draw a line through the air velocity of 75 fpm on the left. At the intersection with the central scale, read the air flow at 15,400 cfm on the right hand side of the scale.

This chart is based on:

$$F = 3.1\ XLV$$

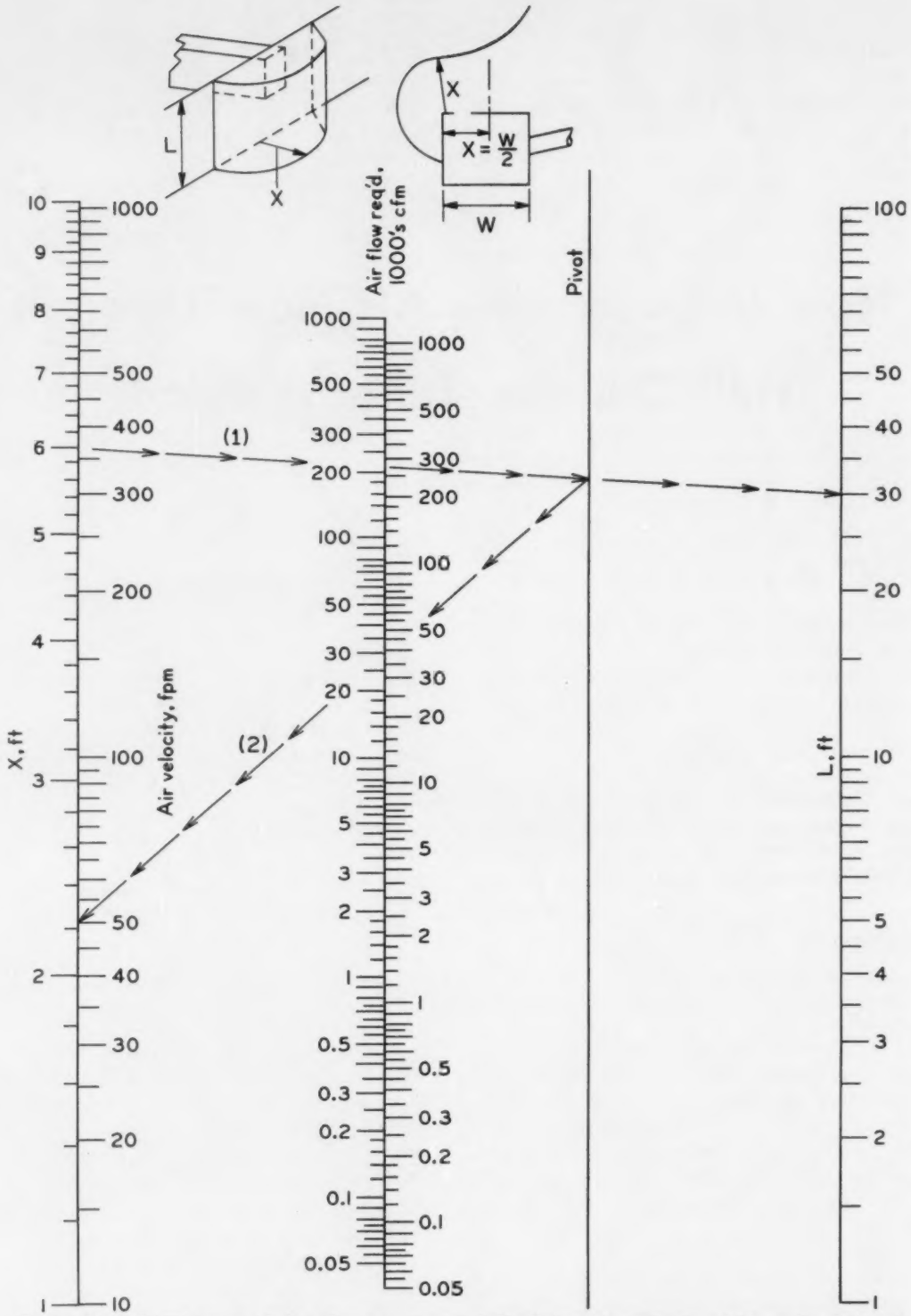
and

$$F = 4.1\ XLV$$

where:

F = exhaust flow, cfm
X *and* L = hood dimensions, ft, as illustrated on the nomograph
V = air velocity, fpm.

Note that the left and right sides of the air flow scale correspond, respectively, to the types of hoods illustrated. Air flow for a particular hood is read on the scale directly below the illustration. The dimension L is read perpendicular to the plane of the paper for the hood on the right hand side of the scale.



THIS NOMOGRAPH lets you find air flow rates through half-cylinder exhaust hoods quickly, easily. Left and right sides of air flow scale correspond to types of hoods illustrated. See preceding page for instructions. Lines (1) and (2) plot Example 1 given in explanation

Case Histories from a Consulting Engineer's Files

By C. T. BAKER
Consulting Engineer

Modern heating, piping, and air conditioning systems, for efficient and satisfactory operation, must be correctly designed. Here is a typical case from the author's experience where original design was faulty and had to be corrected.

• redesign corrects pressure drop

A SMALL ammonia refrigerating plant cooled three rooms in a wholesale market. The owners complained of high power costs and of the failure of the compressors to maintain the required temperature in the rooms. Because of the small connected motor load, the plant did not qualify for the industrial rate for electric service. Their power cost about 2 cents per kwhr.

When making the installation, the owners decided on a "do it yourself" policy. They contracted for the installation of the two compressors and the condensers, but elected to do their own piping and coil erection.

All coils were fabricated from 1¼ in. Schedule 40 steel pipe. An examination of the hookup of these coils, shown in Fig. 1, discloses the reason for the long running time of the compressors. It also explains the principal reason for high power costs.

The coils in the two small rooms were connected in series, as shown. In operation, liquid refrigerant entered at one side of the flat ceiling type coil of room No. 1, while the mixture of gas and liquid left the coil at the opposite side and entered the coil of the adjoining room.

The size of the pipe connecting the coils of the two rooms was reduced from 1¼ in. to ¾ in. The entire suction line connecting the coils of the three rooms with the compressors was ¾ in.

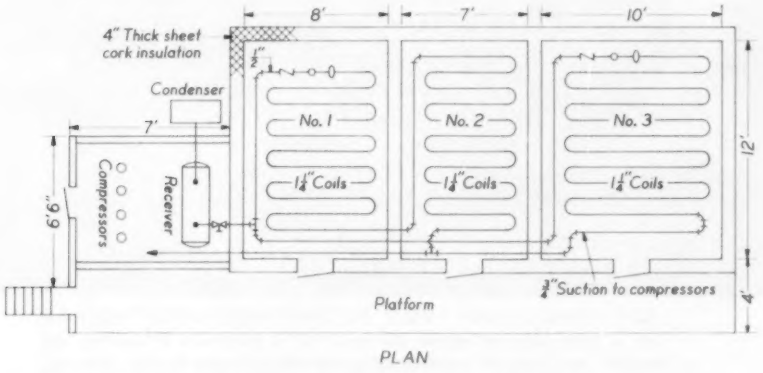
The pressure loss was further aggravated by several right angle elbows and some valves, all of which, of course, were required.

With the coils in the two small rooms connected in the manner shown, it was not possible to control the temperature in these rooms separately. For example, if room No. 1 was satisfied, the room thermostat would close the solenoid valve. This not only stopped the flow of refrigerant to that room, but also to room No. 2. Oftentimes cooling is closed to this room before its temperature is lowered to the desired point.

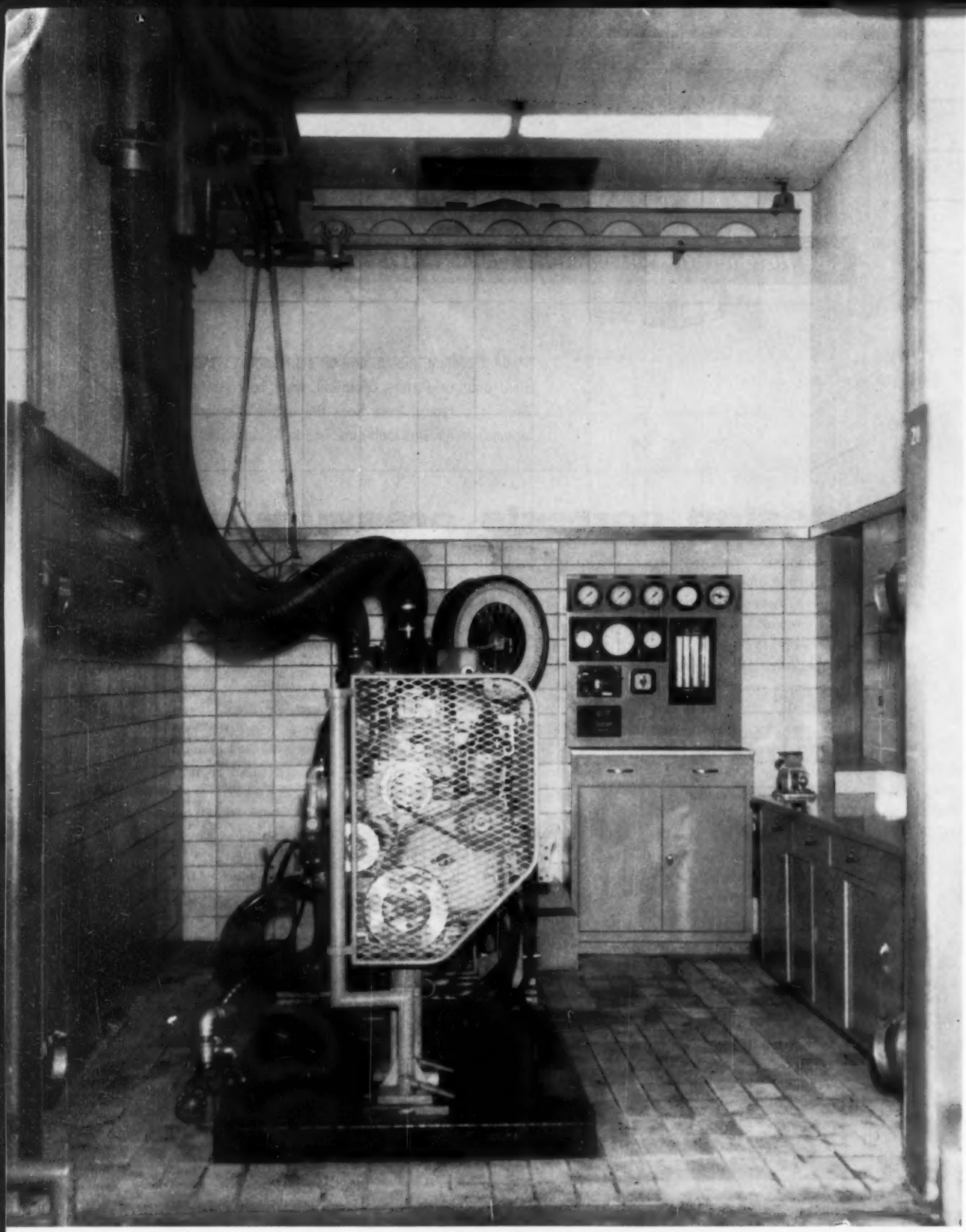
The piping was changed to correct the trouble that resulted from pressure loss and from the inability to close one room off without affecting room No. 2. A pressure gage placed between the thermal expansion valve and coil in room No. 1 showed a pressure drop through the two coils in series of 6 psi. A gage on the suction outlet of the coil in the larger room and one located near the suction inlet of the compressors showed the same pressure loss.

By changing the piping layout, this was corrected. The connection between the two coils was increased to 1¼ in., as was the suction line.

The result of these and other improvements reduced the running time 20 percent. In addition, one compressor handled the load at all times, leaving one as a standby. ≠



1 COIL HOOKUP in this system was cause of operating difficulties



ADJUSTABLE SOCKET TYPE AIR DIFFUSERS introduce ventilation air at both sides of engine test cell. Air is exhausted at ceiling. One flexible duct delivers conditioned air to engine; other flexible duct conveys engine exhaust to mufflers on roof

"Spot-Cooling" System Ventilates New Diesel Engine Testing Plant

• Most any engineering problem has more than one answer. The design of diesel engine test facilities being no exception, the door was open to several alternatives at Cummins Engine Company, Inc. for a system that would most satisfactorily meet the design goals. After a thorough analysis of all possibilities, a design was finalized which today gives peak operating efficiency and worker comfort at low cost.

By H. W. SCHIEWE
Mechanical Engineer
Samuel R. Lewis & Associates
Consulting Engineers

THE PROBLEMS faced in designing a diesel engine testing plant are compounded by the need for making these areas habitable for employees. A recently completed engine testing building for Cummins Engine Company, Inc., Columbus, Ind., provides a striking example of the steps taken to solve these problems.

The plant comprises about 150,000 sq ft of floor area at the operating level, housing production test facilities and auxiliary assembly and shipping areas. A ground story level beneath (of approximately the same area) houses process piping, pumps, ventilation equipment, toilets, and live storage. All areas are related, in order to provide an efficient flow of material and to allow maximum flexibility for future expansion.

In the May issue, Lester S. Ries's article, *Ultra-Modern Engine Plant Demands Unique Heating, Ventilating Systems,* discussed the revolutionary engine assembly and test facilities incorporated in the recent addition to General Motors Corp.'s Detroit Diesel Engine Div. plant. That report has prompted H. W. Schiewe, mechanical engineer for Samuel R. Lewis & Associates, to describe the method used by Cummins Engine Company, Inc. to solve similar design problems with a somewhat different approach.—Ed.

The primary purpose of the building is to provide facilities for testing every diesel engine under load. Finding a way to provide these facilities set the design goal.

Experience at this plant and at similar installations indicated many features to be avoided. Studies of various operational problems brought out the fact that precedent was not the only guide. A fresh viewpoint was required if a truly modern and satisfactory condition were to be achieved.

Satisfactory engine testing facilities that provide good working conditions for the employees, in turn help to provide an efficient testing operation. Good working conditions were defined, in preliminary discussions, as providing good ventilation for the operating personnel, maximum escape of heat from the operating engine, reduction of noise of engine operation, working areas free from mechanical obstructions, and means of easily moving the engines through the test procedure. These requirements could be satisfied only by close cooperation between the owner, the architect, and the engineer.

Several possible solutions to each problem were checked and re-checked before the final design for test cell services was produced. The material handling system installed affords flexibility that can keep pace with varied schedules encountered in production testing.

Each engine is tested in a cell that is open to a main aisle but enclosed on three sides. The cell is provided with acoustical treatment to absorb a portion of the noise generated by the running engine. Thus, the testing engineer gets relief from noise of adjacent units operating when his engine is being set up or being moved out of the cell.

Systems for delivering fuels, lubricating oil, engine cooling water, dynamometer water, compressed air, etc., are installed in the lower level. They connect to each cell. Much of the piping is eliminated from each cubicle and is installed where it is accessible for change or repair. Instrumentation from a fixed console is made accessible at the engine through an underfloor conduit. Therefore a spider web of tubing in each cell is avoided.

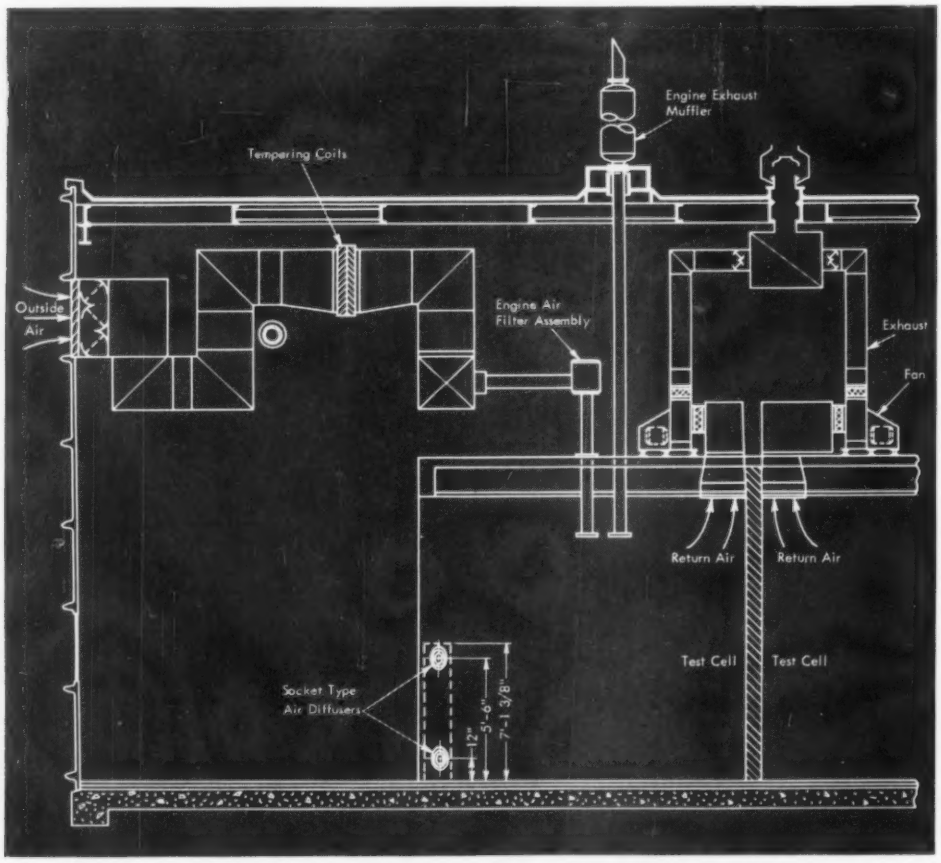
Combustion air is supplied through a closed system which takes air from the outdoors, warms it when required, filters it at each engine intake, and delivers it directly to the engine. Engine exhaust is discharged through roof-mounted mufflers.

The independent source of air satisfies the widely fluctuating demand imposed by the operation of one or of many engines of different sizes, without affecting the stability of the air pressure within the space.

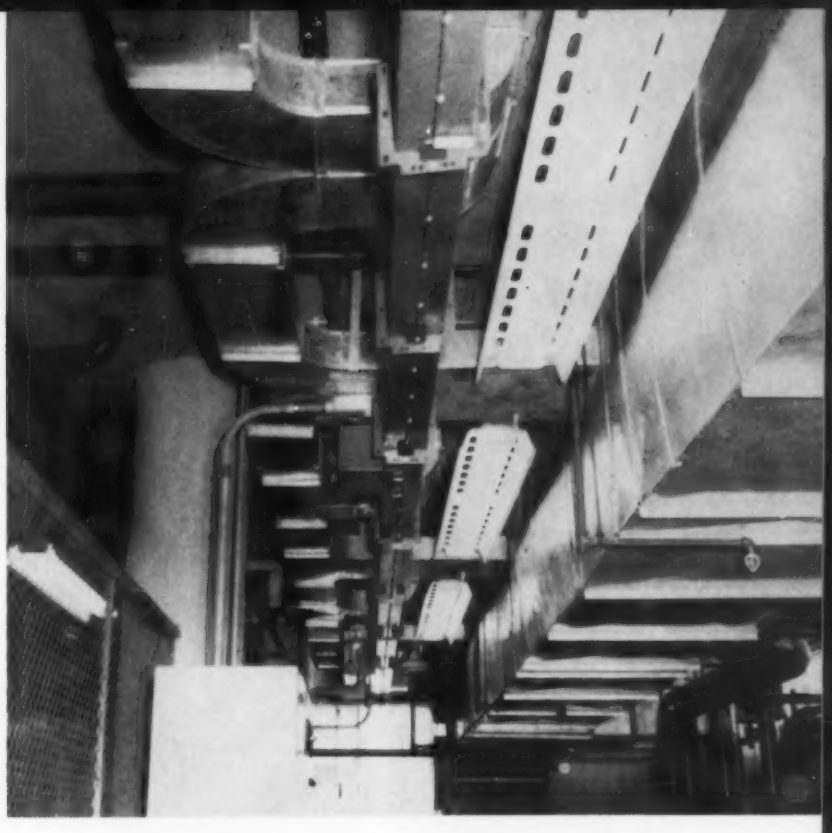
Test Cell Ventilation Most Critical

Of all the problems studied, none received more attention than that of test cell ventilation. Because of its importance in helping to provide comfortable working conditions, it demanded serious study. Mechanical refrigeration was discussed, but was avoided to reduce investment and operating costs. An alternative method, that of moving sufficient quantities of outside air to absorb the heat given off by the engines and the attendant hot equipment, was also discarded. This last scheme required moving so much air that the initial cost of equipment, plus the space required for its installation, plus the cost of electric energy required to move this air, made it impractical.

The method finally selected and installed is a "spot-cooling" system such as is employed in marine engine rooms. Each cell is provided with four adjustable air outlets located at the entrance of each



OUTSIDE AIR for engine combustion performance tests is tempered, filtered through duct system at left. Test cell is "spot-cooled" by air introduced through socket type air diffusers



SUPPLY AIR for engine test cell is delivered through basement trunk duct at right to branches at left and up to socket type air diffusers at both sides of each test cell

cell. Two outlets are at each side of the entrance.

The two top outlets are located 5 ft, 6 in. above the floor and the lower two are 12 in. above the floor. Each discharges 500 cfm of air at 2500 fpm along each side of the engine being tested.

The air stream enters in close proximity to the testing engineer, cooling him with moving air from shoulder height down to his ankles. The volume and temperature of this air can be adjusted to his comfort during the winter and can be as cool as outdoor conditions permit during the summer. An outlet grille in the ceiling allows the air which has been heated by the operating engine to escape.

Ventilation air is delivered to the test cells by equipment located in the ground story below. Air is taken from the outdoors, is filtered and heated as required, and is discharged through a trunk duct under controlled static pressure. This central air system starts automatically when a testing engineer throws the switch in any cell of the group served. A static pressure regulator in the main trunk duct modulates motor driven dampers in a bypass duct which delivers air from the discharge to the suction side of the supply fan when the total supply air quantity is not required.

ENGINE EXHAUST mufflers extend vertically from roof. Roof ventilators exhaust ventilation air from cell

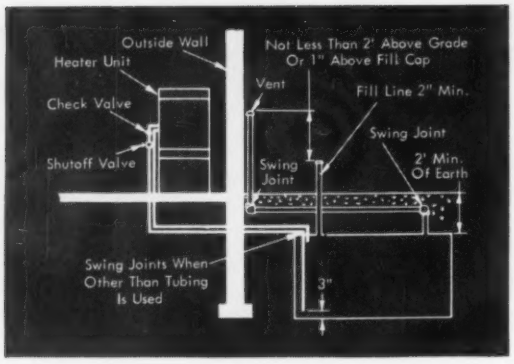
Each test cell has a branch duct leading from the main air supply duct to the four air outlets. A motor operated damper in each branch duct is opened or closed through a switch in the cell to provide ventilation when required.

Each cell is further provided with a ceiling exhaust fan which withdraws the heated air and discharges it outdoors. The exhaust fan motor is energized or de-energized by the same switch that controls the air supply to the cell, so that ventilation in each cell is provided only when the cell is in use.

The plant has been in operation since January. Observations of conditions produced and comments from personnel using the facilities indicate that the goals set in the preliminary stages have been attained.

The system was designed by Samuel R. Lewis & Associates, consulting engineers. Harry Weese and Associates was the architect. ⧺

How to Design Fuel Oil Piping Systems For Direct Fired Heater Installations



1 TYPICAL PIPING arrangement for fuel oil supply to single heater using light oil and buried tank is pictured at left

• Direct fired heaters for industrial plants are used either singly or in multiples. The designs of the fuel oil piping systems for these installations differ considerably. This article outlines the step-by-step procedures in designing these piping systems, and presents a sample problem to illustrate the design of a typical system for a multiple heater installation.

Mr. Stern, a 1943 mechanical engineering graduate of Northwestern Technological Institute, has broad experience in the field of industrial heating equipment. Prior to joining Lennox three years ago, he was president of a business which designed and manufactured large capacity direct fired space heaters. He is the author of two articles on the subject of direct fired heaters which appeared in the March and April issues.

By M. H. STERN
Industrial Market Manager
Lennox Industries, Inc.

FUEL OIL distribution systems in use today with large capacity direct fired heaters fall into two classifications: They are either single heater or multiple heater installations. Each requires a different piping system. A typical piping arrangement for a single heater using light oil and a buried tank is shown in Fig. 1.

This simple oil supply system consists of the following components:

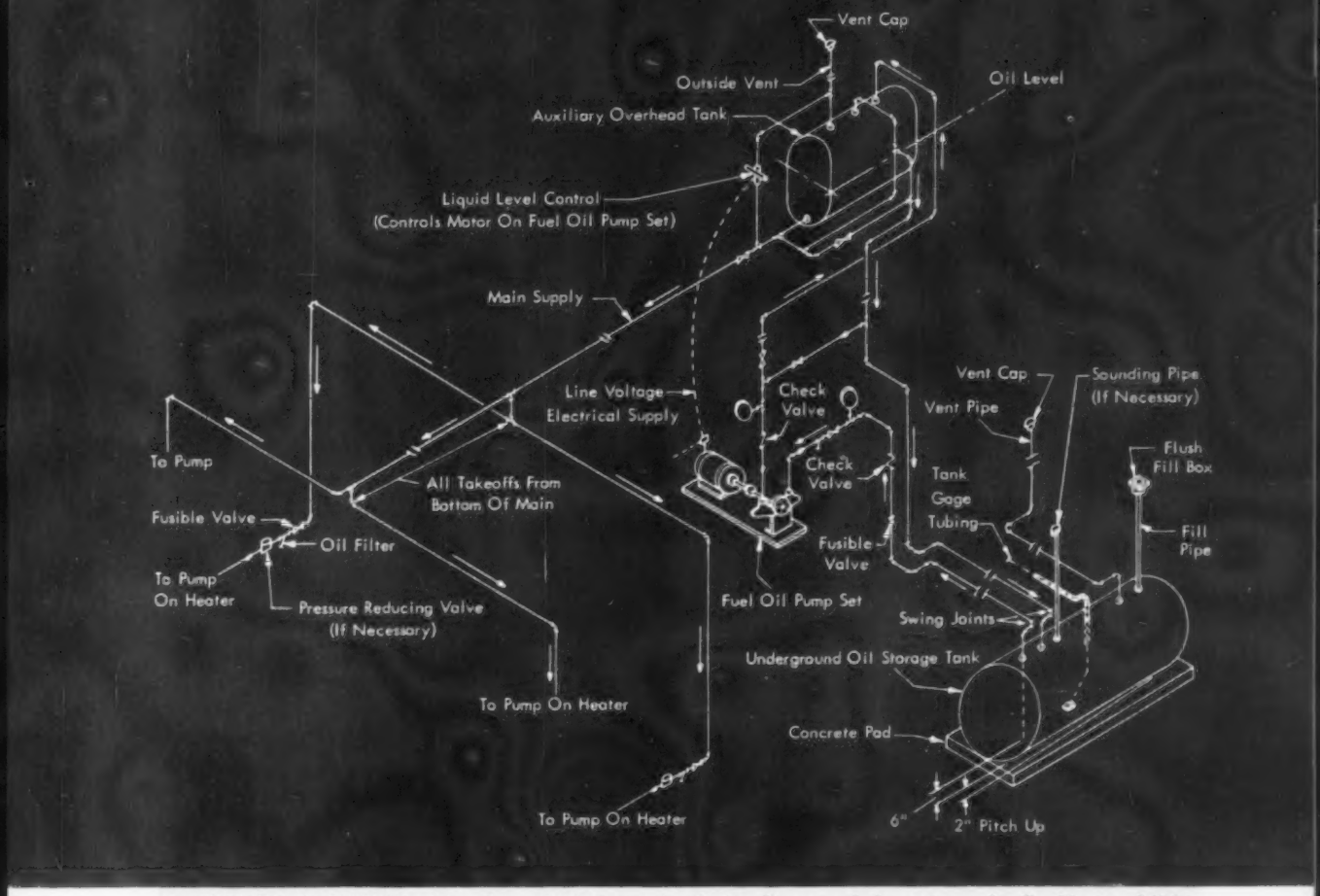
1) Suction type gear pump, as an integral part of the burner.

2) Suction and return lines. This is a two-pipe system, which should be used on all installations where the burner pump has a direct suction from the tank. With this piping arrangement, air that might leak into the piping system is returned to the tank and does not cause a flame-out. A fusible oil valve is usually required by local codes and is installed at the burner location. This valve is constructed so that it will close if exposed to higher than normal ambient temperatures.

3) The oil storage tank capacity is sized in accordance with the consumption rate of the heater and economical local delivery quantities. If the installation fuel consumption rate is large, the tank capacity should be large enough to take advantage of tank truck or rail tank car fuel rates. Their deliveries are normally 5000 to 8000 gal each time.

Regulations covering the installation of oil tanks vary locally, but usually follow the National Board of Fire Underwriters' pamphlet No. 31.

The oil pumps furnished with oil burners using No. 2 oil or lighter will operate properly if the following design conditions are not exceeded:



2 GRAVITY OVERHEAD piping for multiple heater installation diagrammed above. System handles No. 2 and lighter fuel oils

Pipe size — ½ in. pipe or tubing
Maximum lift — 15 ft
Maximum run — 150 ft total supply and return

If it is necessary to exceed the above conditions, an auxiliary supply pump should be incorporated in the system. Its capacity should be twice the burning rate of the heater.

Multiple heater installations require a fuel distribution system. Typical systems are illustrated in Figs. 2, 3, and 4.

The following procedure should be used in designing a multiple heater fuel distribution system, either for a gravity or a pressure feed:

1) Locate the heaters on the floor plan according to air distribution requirements.

2) Select a tank location that will permit the most economical piping and easy access.

3) Determine the total hourly fuel consumption rate of each heater to be served by the oil system. Use the equipment Btu per hr output, burning efficiency, and the Btu per gal content of the fuel in the following relationship:

Gph = Btu per hr output of equipment/(efficiency × Btu per gal)

4) Determine the oil viscosity from the oil grade number you are using and the ambient temperature surrounding the pipe.

5) Select pipe sizes for gravity systems based on viscosity, fuel flow rate, and allowable pressure drop. For pressure systems, base pipe size on a maximum total system pressure drop of 35 to 50 psi.

6) Select oil pumps based on total operating head and a circulation rate of twice the gph consumption rate of the heating equipment. Duplex pumps are recommended when an oil distribution system is to be used, since failure of the supply pump could result in the entire heating system becoming inoperative. The cost of a standby pump is usually insignificant compared to the overall installation cost. See Fig. 4 for a typical piping system using a duplex pump set.

7) Size the oil storage capacity to be not less than 10 percent of the annual consumption.

The following sample problem

in which a pressure piping system is required will illustrate the design procedure:

Data:

Fuel ..... No. 4 oil
Btu per gal content . 147,000
Equipment Btu per hr output ..... 10 million
Total annual fuel consumption, gal . 160,000
Ambient temperature, F . 40

Solution: Since No. 4 oil is to be used, the piping system will be designed as a pressure-feed loop system with a drop to each heater. This system can also be used with No. 2 oil, but the gravity feed system must be used only with No. 2 oil. An example of a pressure feed loop system is shown in Fig. 4.

1) Locate the heaters on the floor plan according to the air distribution requirements and note the length of pipe required.

2) Select a tank location for easy access and economical piping.

3) Determine the total hourly fuel consumption rate for all heaters combined, using the following equation:

$$\text{Gph} = 10{,}000{,}000/(0.80 \times 147{,}000) = 85 \text{ gph}$$

4) Determine the oil viscosity. No. 4 oil at 40 F will have a viscosity of approximately 600 Saybolt Second units.

5) Size the pipe loop for a maximum flow rate of twice the total hourly fuel consumption. This would be 170 gph. Select a pump pressure not to exceed 35 to 50 psi.

The allowable piping loss can be determined from the following relationship:

Pump pressure = piping loss + suction lift + discharge head

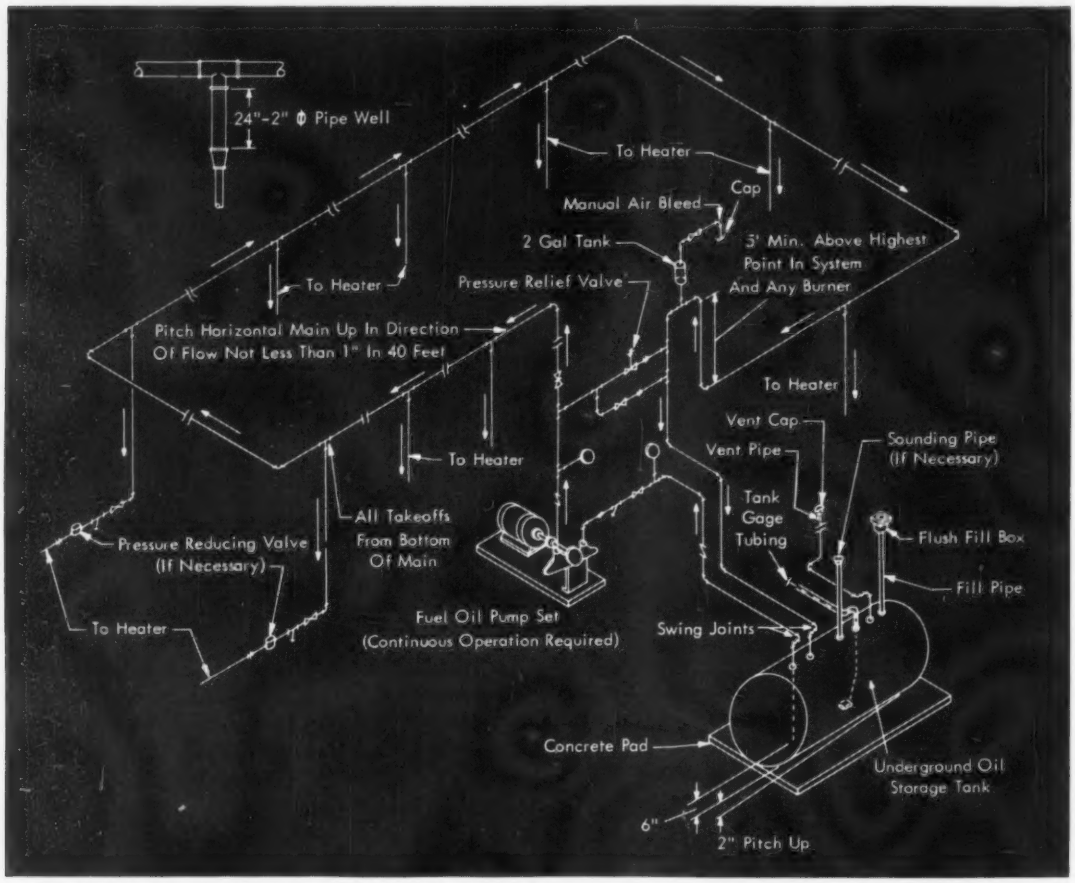
Transposing,

Maximum piping loss = pump pressure − suction lift − discharge head
= 35 psi − (12 × 0.434 × 0.92)
− (20 × 0.434 × 0.92)
= 35 − 13
Maximum piping loss
= 22 psi

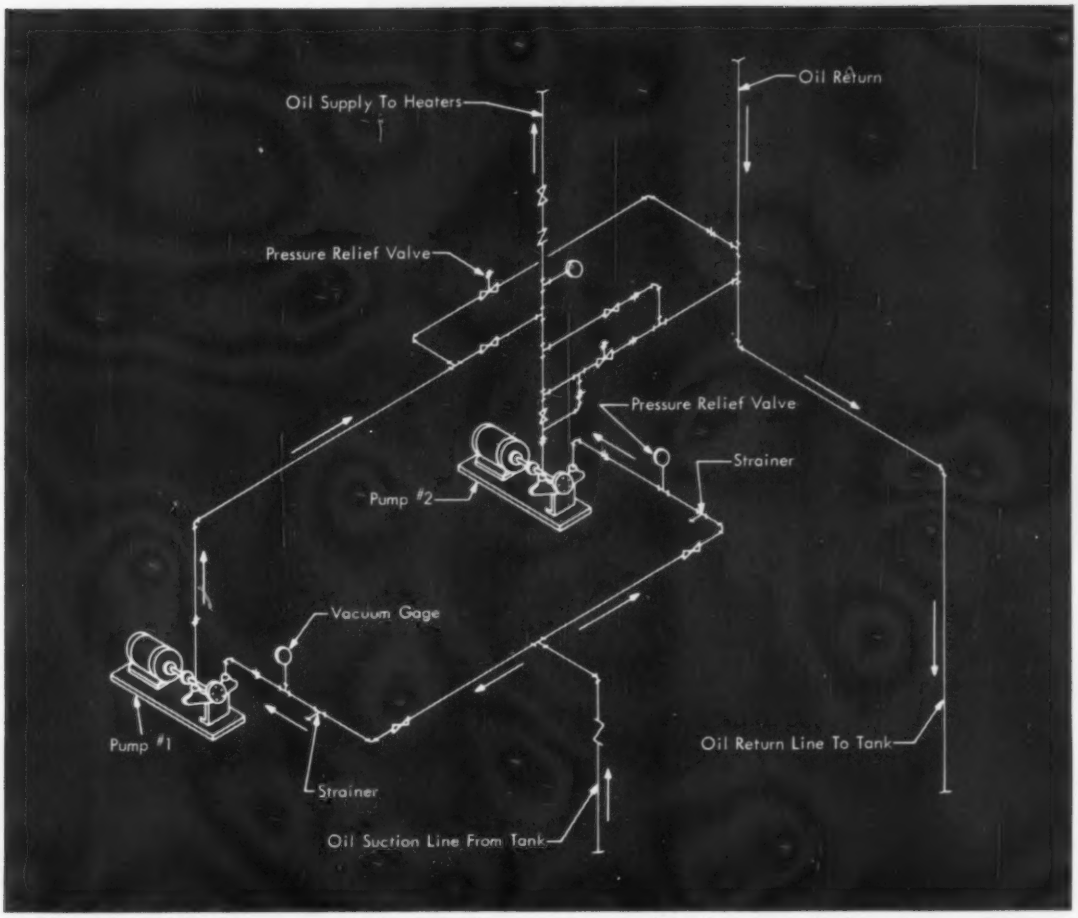
Next, select a pipe size. Assuming the proper pipe size to be 2 in., calculate the equivalent length of the oil loop as determined by the number of fittings contained in the piping system.

Actual pipe length determined from layout	1700 ft
Equivalent length of fittings (assumed)	300 ft
Total	2000 ft

Consult piping pressure drop



3 PRESSURE OVERHEAD No. 4 and lighter fuel oil piping diagram for multiple heater installation shown above



4 THIS OIL PIPING diagram uses duplex fuel oil pump set to guard against system shutdown if one supply pump should fail

charts to determine the piping loss per 100 ft for 2 in. pipe at a flow rate of 2.8 gpm, or 170 gph, at an oil viscosity of 600 Saybolt Second units. This is approximately 0.60 psi. The total piping loss would then be:

Piping loss = (0.60 psi × 2000 ft)/ 100 ft = 12 psi

Since the allowable drop due to pipe friction can be 22 psi, a smaller pipe size can be used, thus reducing cost of both labor and materials.

Next, try 1½ in. pipe and recalculate the total pipe length. This is determined to be 1800 ft as compared to a length of 2000 ft for 2 in. pipe. The actual length of pipe in each case is the same, but the equivalent length due to the fittings is less for the smaller pipe size.

Consulting the pipe pressure drop chart for 1½ in. pipe, the pressure drop is now approximately 1.5 psi per 100 ft at the same flow rate and oil viscosity. The piping loss would then be:

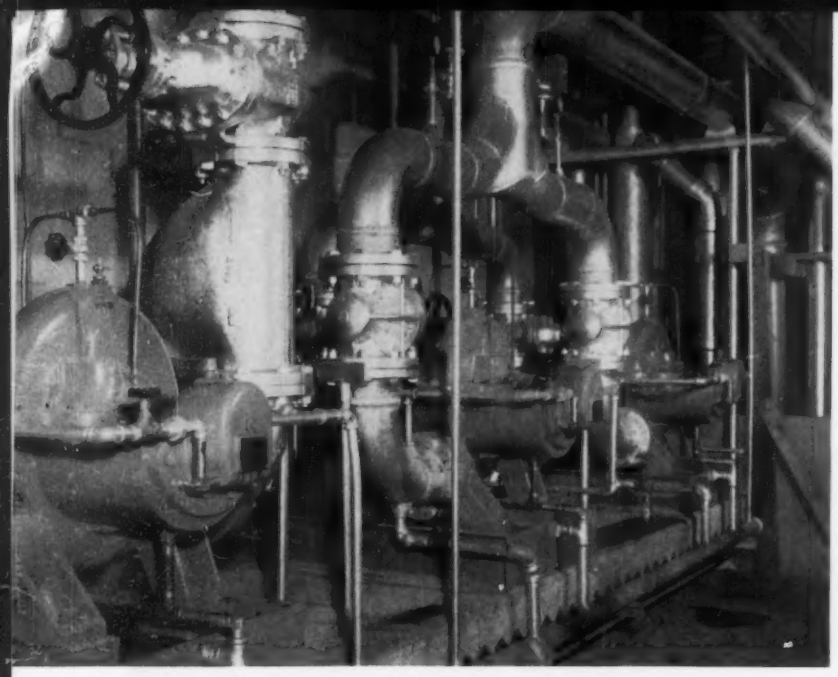
Piping loss = (1.5 psi × 1800 ft) /100 ft = 27 psi

The total system pressure loss would be a 27 psi piping loss + 13 psi suction lift and discharge head, or 40 psi which is 5 psi higher than usually desired. But the savings in installation cost will more than compensate for the pump size increase if 35 psi total pressure were used. Under no condition, however, should the pump supply pressure exceed 50 psi.

Select the duplex supply oil pumps on the basis of delivering oil at a rate of 2.8 gpm at a total pressure of 40 psi. The oil pumps will be in constant operation to keep the oil circulating at all times, which prevents the formation of sludge in the oil tank and distribution system and maintains a constant supply of oil.

Size the oil tank for 16,000 gal, which represents 10 percent of the total annual consumption. (For this example, total annual fuel consumption is estimated.)

Another article will be presented in an early issue in which the design of gaseous fuel piping systems for large direct fired heater installations will be discussed. ⧺



TWO 900 gpm pumps on each floor circulate condenser cooling water over redwood cooling tower. A third pump of same capacity on each floor handles hot water for heating

Packaged Units Condition Dallas Furnishings Mart

• Packaged horizontal air conditioning units—221 in all, with a total cooling capacity of 1184 tons—afford the ultimate in flexibility to meet the year 'round heating and cooling requirements of the windowless, 420,000 sq ft Dallas Home Furnishings Mart. With peak loads occurring only during trade shows and when the mart is opened to buyers, an engineering analysis pointed to these ceiling-mounted units (to conserve valuable floor display space) as the best way to give 185 tenants individual room control. Two equipment rooms, one on each floor, house three 900 gpm centrifugal pumps each that deliver chilled and hot water to the units.

Mr. Balka, now retired, earned his BS and MS degrees in mechanical engineering prior to World War I. He is responsible for the design, in 1929, of a −90 F room for testing lubricating oils, and, in 1934, of a large laboratory and office building cooling system which used propane as a refrigerant—one of the first such applications. Mr. Balka opened his consulting engineering office in 1940 and, until his retirement in May of last year, designed the mechanical systems for numerous large buildings.

By WILLIAM H. BALKA
Consulting Engineer

THE Dallas Home Furnishings Mart is the first completed building of a regional wholesale market center complex which will eventually include, in addition to this building, a complementary household items center, a large motel, a restaurant, and a trade show arena. The complex is designed to provide modern facilities for the display of furnishings in an atmosphere of comfort and convenience for wholesale buyers.

The mart, already in operation, is a two-story windowless structure with a total floor area of approximately 420,000 sq ft, three-fourths of which is divided into separate

INSTALLED SNUGLY against ceilings, packaged air conditioning units solve needs for heating and cooling each individual display room, save floor space

sales and display rooms sufficient to accommodate 185 tenants.

Large areas of glass are used to enclose the display spaces in order to preserve the impression of spaciousness within each room. The remaining space within the building is devoted to corridors, lobbies, indoor gardens, restaurants, and other public rooms.

Construction of the building was planned as a two-part project, the first half of which was completed in 1957. The developer began construction of the second half before the first half was finished, and the completed building was opened in 1958.

So that the building might best serve the needs for which it was intended, prospective tenants were queried regarding their individual requirements for air conditioning facilities. With the help of this information, various criteria were set up to assist in the selection of a satisfactory air conditioning system.

An important consideration was that peak loads would be encountered only during the several weeks of the year when furnishings shows were in progress and on the two days of each month when the entire center would be open to buyers. At other times, only a few office areas would require full heating or cooling control.

Need Extreme Flexibility

It was apparent that extreme flexibility was required in the system in order that tenants might be supplied with properly conditioned air on their own time schedules, independent of other tenants. In addition, it was desirable that tenants be accountable for their own utility bills. In effect, we required a separate system for each display space—one that would be operated by the tenants and which would provide either heating or cooling on demand.

After analysis of these requirements we decided to build the system around packaged horizontal air conditioning units installed in each display room. These would be ceiling mounted in order to conserve valuable floor space.

One or more units would be located in each space, depending upon the size and location of the

WINDOWLESS Dallas Home Furnishings Mart encloses 420,000 sq ft of air conditioned space

room and the loads to be served. Additional units would be installed in corridors and other public areas as needed.

In selecting the units, we required that each be equipped with a hermetically sealed refrigeration machine, provision for the incorporation of a heating coil, automatic temperature regulation controls, a slow speed fan that would handle a relatively large volume of air with minimum noise, and a design which would allow for directional air distribution. Vibration mountings would further reduce the noise level within each room.

The complete system employs 221 units of 7½, 5, and 3 ton capacities, with a total capacity of 1184 tons. Two double-cell cooling towers, each with a nominal capacity of 585 tons, are mounted on the roof.

Insure Uninterrupted Service

Two equipment rooms, one above the other, house the water heating and transfer equipment. Such an arrangement was well-suited to the designed layout of the building, and afforded us the additional advantages of simplified electrical wiring. More important, it allowed for the manifolding of pump piping during necessary maintenance shutdown of the pumping equipment, insuring the availability of uninterrupted service at any time.

Under normal split-service conditions, each equipment room serves one two-story section, with the exception of corridor spaces which are handled locally.

Six centrifugal pumps, each capable of discharging 900 gpm at a pressure of 90 psi, are required for heating and cooling water transfer. Each is driven by a 60 hp a-c motor, operating on 208 volt power. A single transformer accomplishes the step-down from 4160 volt incoming power for all six pumps.

Of the three pumps located in each equipment room, two are used for cooling water circulation; the third carries hot water to the individual unit coils. The cooling water pumps are controlled so that the startup of a compressor in any of the room units will cause one pump to start. When more units are started than can be handled by a single pump, the second is automatically placed on the line. Provision is also made for manual starting.

Again, the third pump in each equipment room handles the heating load. Hot water is supplied by two 3 million Btu packaged boilers, one on each floor, which can deliver a total of 900 gpm of 188 F water to the individual heating coils. This capacity has proved more than adequate.

How Outside Air Is Admitted

Each display space is provided with an outdoor air register located just below ceiling height and immediately behind the room's air conditioning unit. These discharge directly into the space and are equipped with individual dampers. Nine centrifugal fans mounted atop the roof deliver outdoor air through ducts to the various outlets. Four of the fans are of 7500 cfm capacity, four will deliver 6000 cfm, and one is rated 3000 cfm.

The same fans supply air via hot water heating coils to the building's perimeter pipe chase. Besides creating a small heating effect on perimeter areas, this arrangement keeps the condenser water from freezing and reduces temperature loss in the hot water piping system. The tempered air is discharged from the chase to corridor and other public spaces through registers and ceiling diffusers.

Three propeller type exhaust fans, of 14,000 and 14,250 cfm capacities, handle air relief from these areas. These are controlled manually.

The air conditioning units in each display room are controlled by individual thermostats and motorized valves, while the corridor and public space units are equipped with pressure switches on condenser supply lines to start and stop the units in conjunction with condenser water pump operation.

Stress Water Treatment

We took particular care to insure good water treatment control throughout the system so as to attain maximum operating efficiencies with a minimum of maintenance time. Three 24 in. diam. water treatment tanks with a common 200 gal brine tank are used for boiler feedwater softening. Anti-corrosion chemical is introduced to the feed by means of two proportioning pumps. The automatic water softeners are recharged periodically by means of a time clock arrangement.

A water softener chemical feeder tank is located adjacent to each cooling tower. Thirty gal crocks hold chemicals that are fed to the tower basins by gravity after a predetermined amount of water is proportioned through a meter. Tower water treatment includes both anti-corrosion and algae prevention additives.

To date, the system has performed with a high degree of dependability and flexibility. The relatively low initial cost, low operating and maintenance costs, and freedom from the possibility of extensive lost time due to a central plant failure have been achieved to the extent that a similar system was selected for the second trade mart and is now in operation.

The consulting engineer for this job was William H. Balka. The Beard Plumbing Co. was the mechanical (heating, piping, and air conditioning) contractor. Texas Distributors, Inc., air conditioning equipment suppliers, and Ingersoll-Rand Co., pump manufacturer, assisted in the preparation of this article and their cooperation is hereby acknowledged.

the law and your profits

JOHN F. MORRISSEY, author of this regular feature, is an attorney at law and has an extensive practical business and legal background. This series is based on actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Court Issues Injunction Enforcing Valid Limits of Employment Contract

As a rule, management does not like the idea of one of its executives or employees leaving its employ after he has learned a great deal about the business and then starting a business of his own in competition with his former employer. Sometimes an employer will require an employee, before he is hired or placed in a key position, to restrict his right to compete in a similar business.

Of course, such an agreement between employer and employee is governed by the same contractual rules that govern other contracts. For example, the employee must receive something (consideration) in return for his promise. But there is another aspect not ordinarily considered, as the following case illustrates.

I. Kant was a sales engineer for the Forsite Air Conditioning Contracting Co. In his capacity, he had acquired an intimate knowledge of Forsite's operations. He had also made many connections with Forsite's business sources.

One day he decided that he could do quite well in an air conditioning contracting business of his own. He resigned from Forsite and formed a company in the same city in which Forsite conducted its business.

After hearing of Kant's action, Forsite went to court and filed a request for an injunction to prevent Kant from engaging in a competitive business.

To support its request, Forsite offered in evidence a written agreement whereby Kant had promised, in consideration of being hired as sales engineer, that he would not engage in the air conditioning business within the same county for five years after leaving Forsite's employ.

"I was anxious at the time to get the job," said Kant, "and I paid no attention to what I signed. But the agreement isn't valid anyway. It's an illegal attempt to stifle competition. It is of prime public interest to preserve competition. Therefore, the agreement is void because it is against public policy."

"Let him go to another county," said Forsite, "or leave the state. We would not have given him a job if he had not signed the agreement. He should be bound by its terms."

"The agreement," stated the court, "is known as a contract in partial restraint of trade. It is valid only if it is founded upon good consideration. It must only afford a reasonable protection to the interests of the party in whose favor it is imposed and the prohibited area must be reasonable so as not to be injurious to the interests of the general public.

"We find that the limitations placed upon Kant were reasonable. Forsite was entitled to protect itself so long as it did not abuse the privilege. The agreement was valid in all ordinary respects and we cannot say that it adversely affected the public interest."

The court ruled in Forsite's favor, and Kant was not allowed to engage in the air conditioning contracting business for five years within the county.

Although the agreement was held valid, it is apparent that the courts require such contracts to be *reasonably* limited. If Kant had promised never to engage in a competitive business anywhere at any time, undoubtedly the court would have found the agreement to be invalid. ≠

Compare Air For Two New

EQUITABLE LIFE ASSURANCE BUILDING

Architect: Skidmore, Owings and Merrill.
Consulting mechanical engineer: Meyer, Strong and Jones.
General contractor: Turner Construction Co.
Air conditioning contractor: Kerby Saunders, Inc.

These new office buildings, alike in many ways, have contrasting air conditioning systems—both designed by the same consulting engineering firm

By LEWIS SMITH
Heating Engineer

OF THE MANY new office buildings under construction in New York City, two are particularly noteworthy not only because of their size but because they will both be wholly occupied by their owners. One is the 42-story Equitable Life Assurance Society of the United States building going up at 1285 Avenue of the Americas from 51st to 52nd Sts. This structure, 540 ft high, is claimed to be the largest single occupancy office building under private ownership in the world. The other, the 41-story First National City Bank of New York building, will stand 515 ft high at 399 Park Ave. from 53rd to 54th Sts. Both buildings will occupy a full block front on their respective sites.

Both buildings are to be air conditioned by perimeter systems using induction units. These will be supplemented by interior systems of the conventional type, with duct distribution in hung ceilings. Both will have extensive business machine areas (200,000 sq ft in the bank building) requiring special treatment for controlling relative humidity and temperature.

With the two buildings being not greatly different in size, having much the same kind of occupancy, and having been designed by the same consulting engineers along similar lines, it is interesting to compare their respective air conditioning systems. The following data shows the similarities and differences.

	Equitable Life	First National City Bank
Gross building area, M sq ft	1717	1500
Exposed wall area, M sq ft	450	450
Ground area, M sq ft	80	70
Perimeter primary air supply, Mcfm	265	336
Number of perimeter induction units	6139	5100
Primary air supply per unit, cfm	40	66
Interior spaces, air supply, Mcfm	725	435
Total air movement, supply and exhaust, Mcfm	2930	2443
Total cooling capacity, tons	5100	5200

Conditioning Skyscrapers

FIRST NATIONAL CITY BANK BUILDING

Associated architects: Carson & Lundin and Kahn & Jacobs.
Consulting mechanical engineer: Meyer, Strong and Jones.
General contractor: George A. Fuller Co.
Air conditioning contractor: Raisler Corp.

The differences in the quantities for perimeter and interior air supply are due to the depth of the offices, being nearly 30 percent greater in the bank building which also has a greater exposed wall surface per induction unit.

Both buildings will be supplied district steam from the Consolidated Edison Co., each having four centrifugal steam turbine driven compressors. These will be located in sub-basements.

In each case, temperature control of the perimeter air conditioning units is to be by pneumatic room thermostats operating throttling valves in the water supply to the units. For interior office spaces, reheater coils will be used for area zones, there being 217 such coils at the Equitable Life and 230 in the bank building.

Both buildings are designed to have three main mechanical areas—in the sub-basement and above the 15th and 38th floors for Equitable Life, and in the sub-basement and on the 13th and 40th and 41st floors in the bank building. This arrangement provides for splitting the main buildings and tower sections into two levels, with converters or interchangers to keep the static pressure in the perimeter systems down so that standard coils and 150 lb pipe and fittings can be used. Coils suitable for 350 psi pressure are used in the interior systems.

Due to the difference in the layout of floors, the Equitable building will have 34 air conditioning units, the largest one handling 80,000 cfm. The bank building is designed to have 43 such units, the largest one for 72,000 cfm.

Due to the difference in zoning, Equitable requires 25 circulating pumps as against 17 for the other building. In each case, the largest pumps, handling the condenser water, will be driven by 200 hp motors and will handle 3900 gpm. In both buildings, the excess conditioned air from occupied spaces will be utilized for ventilating kitchens, elevator machine rooms, and other working spaces.

The bank building will have a sidewalk snow melting system covering an area of 22,000 sq ft. ∓

Sectional Committee Interprets Code for Pressure Piping

• Since the Code for Pressure Piping, ASA B31.1-1955, was last issued, the Sectional Committee on the Code has been asked to interpret various statements contained therein. While these cases represent the opinion of the committee, they will not become parts of the Code until formal actions have been taken. The cases published below cover the use of ASTM A299 plate for A155 pipe, and the use of A381 pipe in petroleum refinery service.

Case No. 46

Inquiry: ASTM Specification A155 does not list plate made to ASTM A299. May pipe made to Specification A155 using plate meeting the requirements of ASTM A299 be used under Section 1 of ASA B31.1, Code for Pressure Piping?

Reply: It is the opinion of the committee that pipe made to ASTM Specification A155, using firebox quality carbon-manganese-silicon steel plate conforming to ASTM Specification A299, may be used for power piping systems complying with the Code for Pressure Piping ASA B31.1-1955, Section 1, Power Piping, provided the following requirements are met:

1) Pipe shall be Class 1, heat treated, double-welded, and radiographed.

2) Longitudinal joint factor may be taken as 1.0.

3) Allowable stress values (E — 1.0) shall be as follows:

−20 F to 650 F	18,750 psi
700 F	17,700 psi
750 F	15,650 psi
800 F	12,000 psi
850 F	7,800 psi

Case No. 47

Inquiry: Is the limitation placed on ASTM A381 pipe in Subparagraph 305.2.1 (d) of ASA B31.3-1959, Petroleum Refinery Piping, still applicable in view of the increased knowledge available to the committee?

Reply: It is the opinion of the committee that, for ASA B31.3-1959, Petroleum Refinery Piping, the intent of the Code will be met if ASTM A381 pipe is used without the limitation contained in Subparagraph 305.2.1 (d). ≠

Air Conditioning Is Contributing To U.S. Space Research Program

THE air conditioning industry "is making a substantial contribution to the nation's space research program," according to Dr. Finn J. Larsen, vice president and research director of Minneapolis-Honeywell Regulator Co.

Speaking before the recent spring conference of the Building Research Institute, Dr. Larsen described some of the problems connected with the building of a space cabin simulator currently in use for advanced aerospace projects at Brooks Air Force Base in Texas. The capsule is designed for occupancy by two astronauts for a period of 30 days, and simulates on the ground conditions that would be encountered in space.

Dr. Larsen asserted that the techniques employed to supply clean air at correct temperature and proper humidity to the capsule "are not appreciably different from the methods in current use by the air conditioning industry."

"I believe," he said, "we should realize that the commercial and residential air conditioning industry is using the best available techniques, and be proud of the progress that has been made."

Dr. Larsen noted that temperature control of a cabin in space, exclusive of the re-entry problem, might be simpler than similar control on the ground, since heat losses can be controlled by balancing heat-reflecting and heat-absorbing materials on the outer surface of the vehicle. A slowly rotating unit can be used to keep the occupants from roasting on one side and freezing on the other. Occupants would not feel the rotation, once away from the gravitational field of any planet, according to Dr. Larsen. ≠

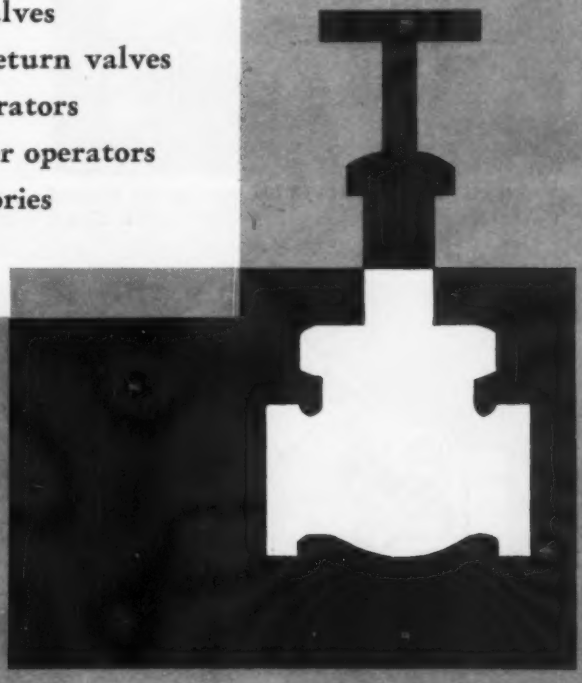
For more information on this subject, see the article, *New Outer Space Cabin Lab Will Provide Valuable Design Data*, by L. N. Becklund (September 1959), and the HPAC Engineering Data File, *Environmental Control: Key to Success of the Manned Earth Satellite*, by H. H. Christman (October 1959).

HPAC ENGINEERING DATA FILE

What to Consider When Selecting Check Valves, Valve Operators and Accessories

- How to apply check valves
- Selecting boiler non-return valves
- When to use motor operators
- Application of cylinder operators
- Specification of accessories

By Carl A. Dopp

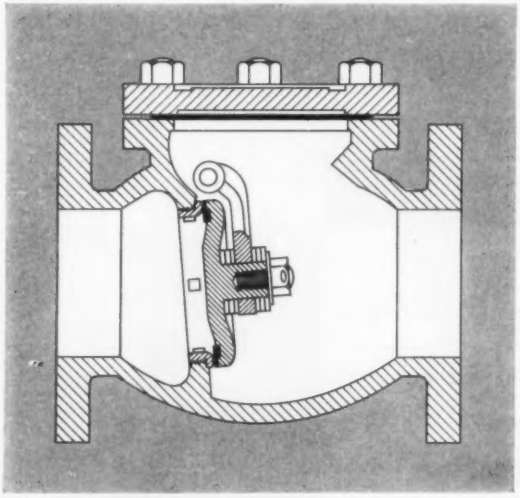


Check valves of many types are available. Their characteristics and how to apply them are presented in this report. The various accessories that are often required if a valve is to properly serve its design function are also presented. These include power operators, special handwheels, indicator posts, and floor stands with extension stems.

The author — Carl A. Dopp — has assembled this information from many sources starting with his experience as directing engineer in charge of the valve and fittings department of Crane Co. from 1935 to 1953. This is the fourth HPAC Engineering Data File he has prepared on valve selection. In January 1959, the general service factors to be considered when selecting valves of all types were considered. The selection of gates and globes was given in April 1959, and a similar discussion of the selection of cocks and plug valves was presented in August 1959.

How to Apply Check Valves

CHECK VALVES are automatic non-return valves. Their purpose is to prevent a reversal of flow in the line. Seat tightness is dependent entirely on the differential pressure in the line. When a reversal of flow occurs, the check valve closes automatically. Naturally, there is likely to be some leakage until the back pressure is high enough to hold the disc tightly on its seat.

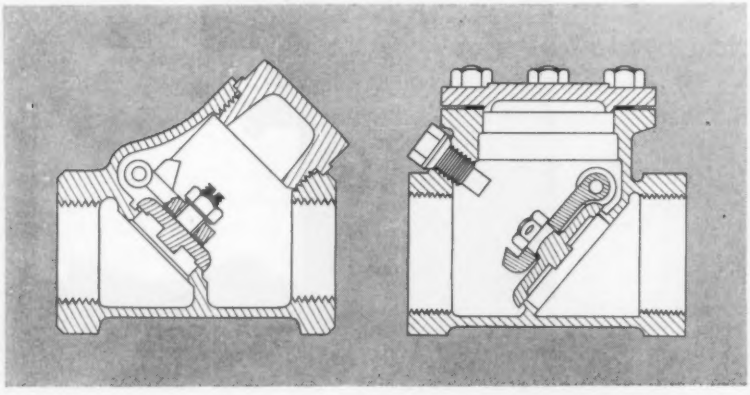


1 SWING CHECK VALVES like one here are designed for horizontal lines and upward flow in vertical lines

Swing Check Valves

Swing check valves are designed for horizontal lines, and for upward flow in vertical lines. The disc is hinged and swings through an arc when opening or closing (see Fig. 1). A swing check valve should never be used for downward flow in a vertical line. If the regular flow is downward, it is doubtful whether a reversal of flow will lift the disc to its seat and close the valve.

The swing check valve has a much lower pressure drop than the lift check valve. The resistance to flow is somewhat greater than in a gate valve as the flow must hold the disc in the open position. Because of the relatively low pressure drop,



2 SMALL BRASS swing check valves are often made with provision for regrinding the seats. "Y" pattern at left and regular pattern at right are common designs

swing check valves are generally preferred for liquid lines.

Small size brass swing check valves for the higher pressures are often made in the regrinding design. Two common designs are shown in Fig. 2.

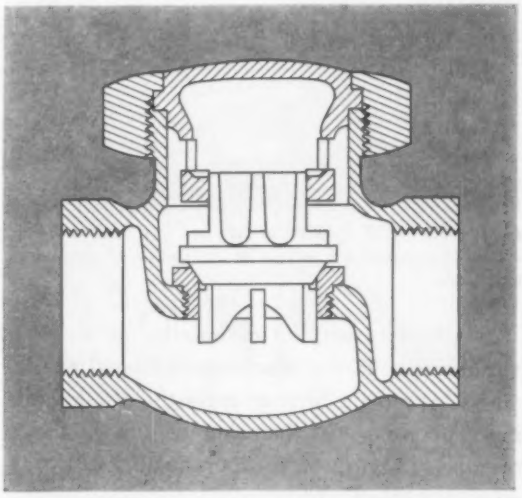
Swing check valves for fire protection lines must always be of the Underwriters' Pattern and should be so specified.

The face-to-face dimensions of flanged end swing check valves have been standardized by ASA B16.10. This standard covers iron and steel valves with regular and ring joint facings.

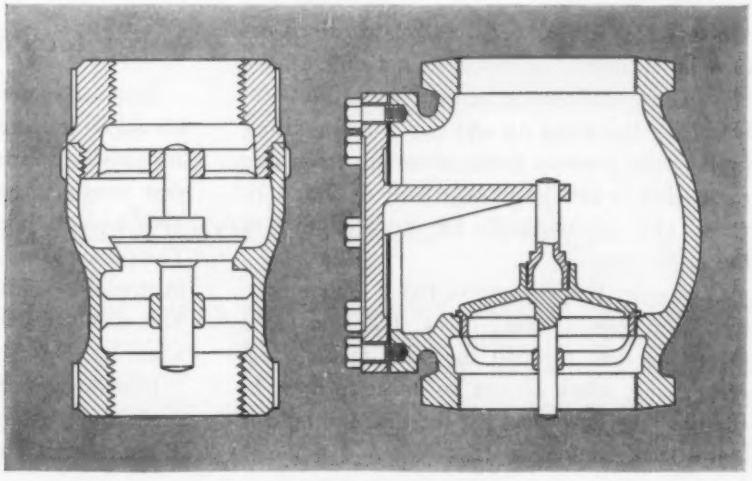
The service conditions should always be included in the specification for swing check valves for use on the outlet of a centrifugal pump or other service where the flow could suddenly reverse direction. A check valve that will close quickly should be selected for this service.

The following experience explains the reason. A customer purchased several large swing check valves and specified that they should be made with an outside lever keyed to the disc. He also specified that each valve should have a dashpot to close the valve slowly. No further details were given to indicate the service.

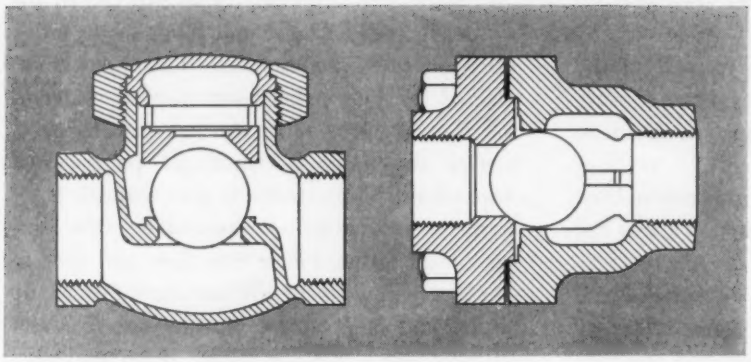
Not long after the valves were put into service the supplier received a complaint. The sales engineer who visited the plant found that the valves were used on the outlets of centrifugal pumps feeding a large tank on the top of a high building. The bracket which held the dashpot had broken and the dashpot was hanging loosely on the end of the lever. The customer stated that he wanted the dashpots to slow down the closing to prevent noise and shock in the valve when the pump was shut off. The engineer explained that when the pump stopped, water in the riser began to flow through the line in a reverse direction. A centrifugal pump when stopped will allow water to pass through it toward the suction side. Because of the slow closing of the valve, the reverse flow had time to create a high velocity. When the valve finally closed and stopped the flow, a severe water hammer shock was inevitable. If on the other hand the valve had closed quickly enough, it would have prevented the change in direction of flow and avoided the water hammer.



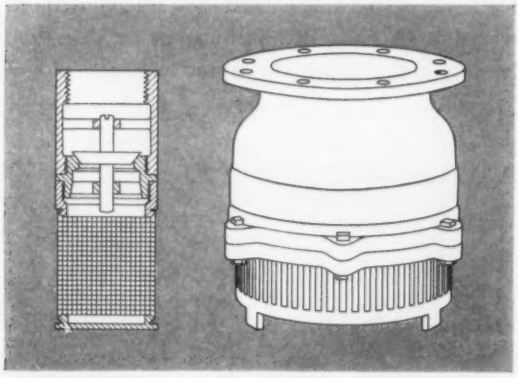
3 LIFT CHECK VALVES with disc arrangements like one shown here are made for use only in horizontal lines



4 VERTICAL CHECK VALVES are specially designed for vertical lines with upward flow. Valve at left is typical brass valve while that at right is typical iron body valve



5 BALL CHECK valves like these should be used only in horizontal lines. The valves shown are typical patterns for small brass valves. Valve at left is used for many services; that at right was designed for hot oil piping



6 BRASS FOOT VALVE at left and iron body valve at right are designed for service on the intake of pump suction lines

To demonstrate the desirability of a quick closing valve in this situation, additional weight was added to the lever to assist the disc in closing. The pump was then shut off and no shock resulted. The use of dashpots in this case was obviously objectionable.

Lift Check Valves

Horizontal lift check valves are so named because they should be used in horizontal lines only. They should never be used in vertical lines. Since the disc slides up and down, and is lifted by the inlet pressure these valves are frequently referred to as lift checks. The body of both horizontal (Fig. 3) and angle lift check valves is of the globe type.

Obviously, this type valve has a higher pressure drop than a swing check. Like the globe valve, the flow through the body makes a reverse curve, which creates resistance to flow. In addition, the flow must lift the disc and hold it in the open position.

Brass horizontal check valves are made with both brass and composition discs in the small sizes.

Vertical check valves are of the lift type and are specially designed for use in vertical lines and upward flow (see Fig. 4).

Ball Check Valves

Ball check valves use a ball instead of the conventional disc. As the ball has a tendency to revolve due to the flow through the valve, its seating surface changes position every time it closes. The action tends to keep the seats clean.

Small brass valves of this type are generally made with globe type bodies (see Fig. 5). They are used for steam, water, oil, and gas in small piping installations. One type illustrated in Fig. 5 was designed primarily for hot oil piping, and was developed for refineries. The ball check closes faster than other types in viscous fluids due to the free action of the ball. They should be used in horizontal lines only.

Valves for Pump Suction Intakes

Foot valves are vertical check valves designed for use on the intake of pump suction lines. They are provided with a strainer on the inlet to prevent foreign matter from getting into the line. Two typical foot valves are shown in Fig. 6. The principal reason for their use is to keep the suction line below the pump filled with water. This eliminates the need for priming the pump when starting up.

Iron body foot valves are generally made to carry low pressure. For this reason, the vertical distance from an iron body valve inlet to the

pump must be less than 34 feet, approximately 15 pounds pressure. Any higher head will cause a break in the water column and make it necessary to prime the pump before starting.

Some engineers use a swing check valve with strainer on the inlet end in place of a foot valve.

Stop-Check Valves

Stop-check valves must be used on all boilers which are cross connected with one or more boilers. This is required by the "ASME Boiler and Pressure Vessel Code."

They are a combination of a lift check and an angle or globe type valve. As shown in Fig. 7, the stem is not attached to the disc. The stem is used only to close the valve when required for boiler testing or shutdown. The disc, being of a lift check design, will close automatically if there is a reversal of flow in the line.

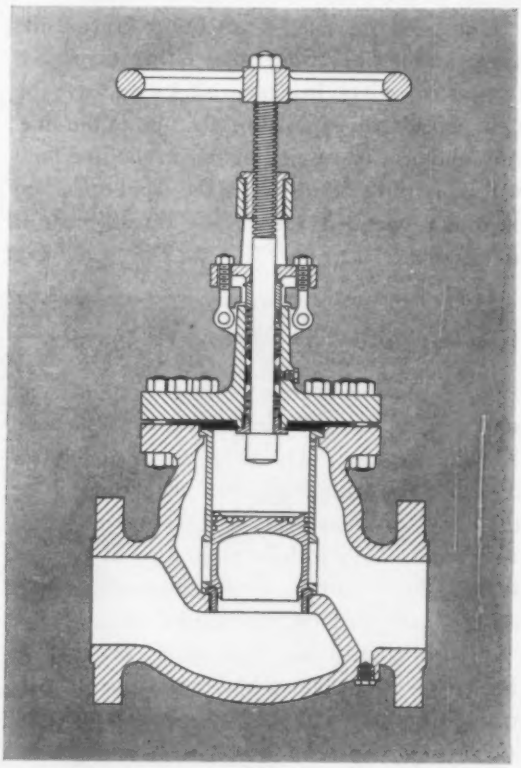
Pressure drop is an important factor to consider when specifying a stop-check valve. Should the valve be too small, the pressure drop will be excessive. On the other hand, if too large a valve is used the disc may float in an intermediate position instead of lifting all the way. Fluctuation of the disc position can cause excessive wear.

Selecting the proper size stop-check valve is a serious matter. Some manufacturers have definite information for determining the proper size for any normal service, and give the necessary data in their catalog. When such information is not available, the specification should include the following data:

1) Maximum pressure.
2) Maximum temperature.
3) Pounds of steam per hour required at full load.
4) Pounds of steam per hour required for minimum load.
5) Size of pipe connection from boiler.

The size of stop-check used may not be the same as the size of the boiler opening. When the stop-check size differs from the boiler outlet, an adapter should be used.

Since a stop-check valve must be closed tight when shutting down or testing a boiler, it is a good plan to consider the use of a hammer blow handwheel on all steel stop-checks in sizes 6 in. and larger, and for pressures over 400 psi.



7 STOP-CHECK VALVES like one shown here are required on cross connected boilers

Application of Motor Operated Valves

Gate, globe, angle, "Y" pattern, and plug valves can be equipped with power operators. Both electric and air motors are used to operate valves.

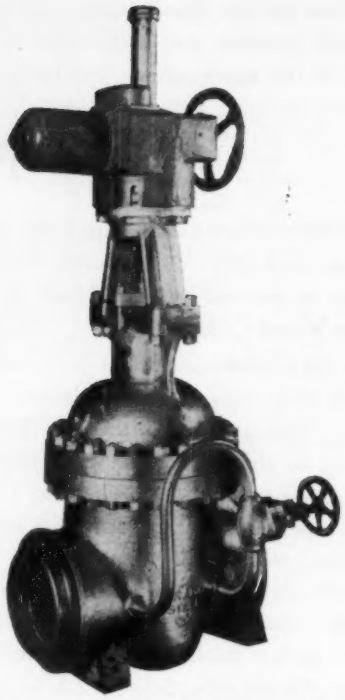
Power operation of valves is essential for the safety of equipment in all large power plants, refineries, and many industrial piping installations. By the use of remote or automatic control the severity of an emergency such as a break in a pipeline may be quickly reduced to a minimum.

Emergency valves can be operated from several different stations, or automatically by pressure switches or other devices.

Power operation opens or closes a valve much faster than hand operation and conserves manpower. When a large valve is in an inaccessible position, the use of power operation should be considered. Power operation should also be considered for extremely large valves.

It must be remembered that the high speed closing of valves in liquid lines can cause serious damage unless proper precautions have been taken to prevent water hammer. Properly sized and located air chambers or shock absorbers should be used in liquid lines having power operated valves.

It is good practice to use OS & Y (outside screw and yoke) rising stem rather than non-rising stem valves. In a non-rising stem valve the stem threads are exposed to the fluid in the line. Any sediment or foreign matter in the line fluid will cause thread wear. With the rapid operation of motor operated valves, any thread wear is accelerated.



8 ELECTRIC MOTOR OPERATED valves like this one permit rapid and remote operation. Air motors are also used. Note that valve operator is equipped with a handwheel to permit operation of valve in the event of a power failure

Electric and Air Motor Operators

Electric motor operated valves are worth considering for high pressure steam, air, and liquid lines (see Fig. 8). Electric motor operators are designed especially for valve operation and are the result of many years of experience and development. They include many special features such as high starting torque, intermittent duty motors, hammer blow mechanism, etc.

Remote control can be accomplished by placing electric push button stations at one or more convenient points. This is a necessity for sectionalizing valves and other services where simultaneous valve operation is required. Sectionalizing valves can be conveniently operated in proper sequence from a central control station.

Indicators to show the position of the valve disc can be supplied for electric motor operated valves. They can be located at the valve and at any desired operating point. It is customary to use push button control stations with red and green lights to indicate whether a valve is open or closed.

Air motor operated valves are sometimes preferred to electric operators in refineries or installations where it is possible for sparks from electric motors or other equipment to ignite an explosive-laden atmosphere. There are, however, explosion-proof electric motors which are used extensively in refineries. Air motors are sometimes used for the control of fire extinguishing water.

The operating unit can be located at the main valve or at a reasonably remote location. Mechanical disc position indicators can be mounted on air motor operated valves. When remote control is required, special explosion proof electric indicators can be obtained.

Motor Operated Valve Specifications

The valve manufacturer requires considerable information to quote or produce a motor operated valve. In addition to that generally included in the specifications for hand operated

valves, the following data is needed for either *electric* or *air motor* operators:

1) Type of service. Sectionalizing, main steam, boiler feed, circulating water, steam, air, oil, gas, etc.

2) Maximum pressure and temperature in the line, or minimum temperature if sub-zero.

3) Maximum differential pressure and operating temperature against which valve will be opened or closed.

4) Approximate atmospheric temperature at valve location.

5) Orientation of piping in which valve is to be installed — horizontal or vertical.

6) If in horizontal line whether stem will be vertical (up or down), horizontal, or other position.

7) Position of operator handwheel; parallel to, or across run.

8) Desired operating speed of disc. (12 in. per minute is reasonable for gate valves, and 4 to 6 in. per minute for globe valves.)

Electric motor operated valves

In addition to the above information, the specifications for electric motor operated valves must include the characteristics of the electric service (voltage, type of current, phase and cycle), the number and type of control stations that will be used, and type of enclosure—weather proof, explosion proof, etc.

Air motor operated valves

For air motor operated valves, the only information needed in addition to that given in items 1 through 8 is the available air pressure.

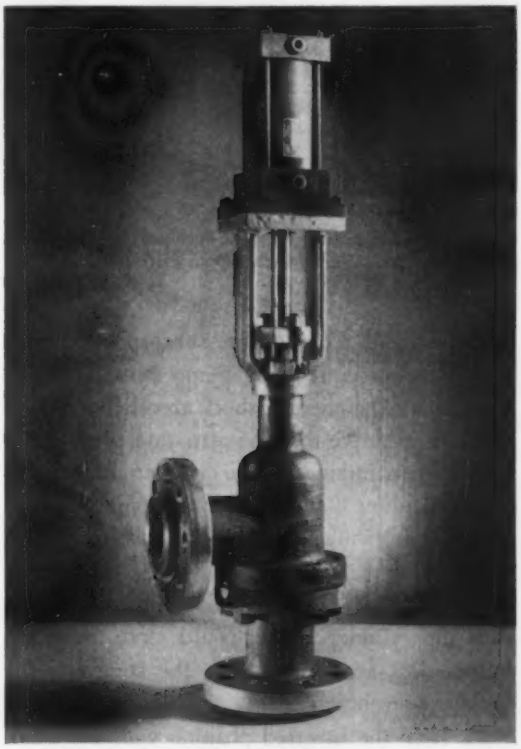
Cylinder Operated Valves

Cylinder operated valves are made for both hydraulic and air operation (see Fig. 9). Cylinder operators are convenient for valves in inaccessible locations. The cylinder operator can be adjusted to obtain any reasonable operating speed. When liquid is used for operation the speed may be controlled by orifices drilled into special fittings in the cylinder ports. The size of orifice controls the speed for opening and closing the valve. If air is used as the operating means, the most satisfactory way to control speed is by regulating the rate of air flow with speed control valves in the operating lines.

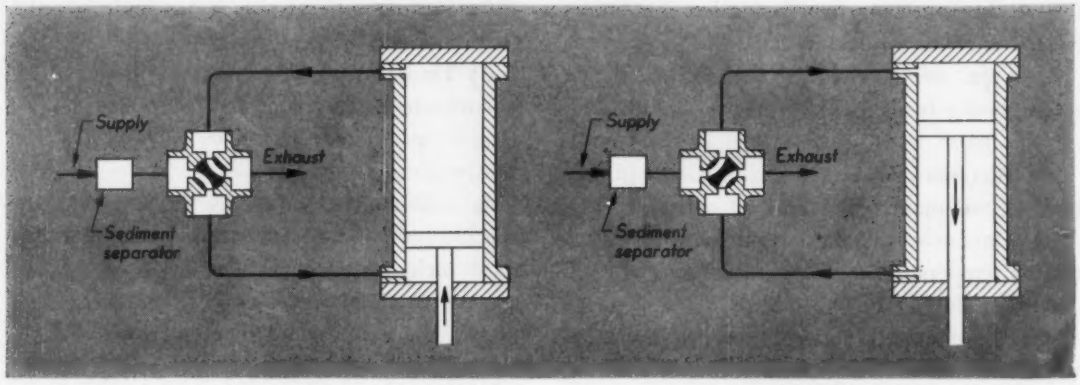
Consider Control Piping

The control consists of piping as indicated in Fig. 10 and four-way valves or cocks as the operating means. To assure continued satisfactory operation, a sediment separator should be installed in the supply line between the source of supply and the four-way valve. Grit, dirt, scale, or foreign matter carried in the operating fluid can damage the piston and interior walls of the cylinder. It can also clog the passages in the control system.

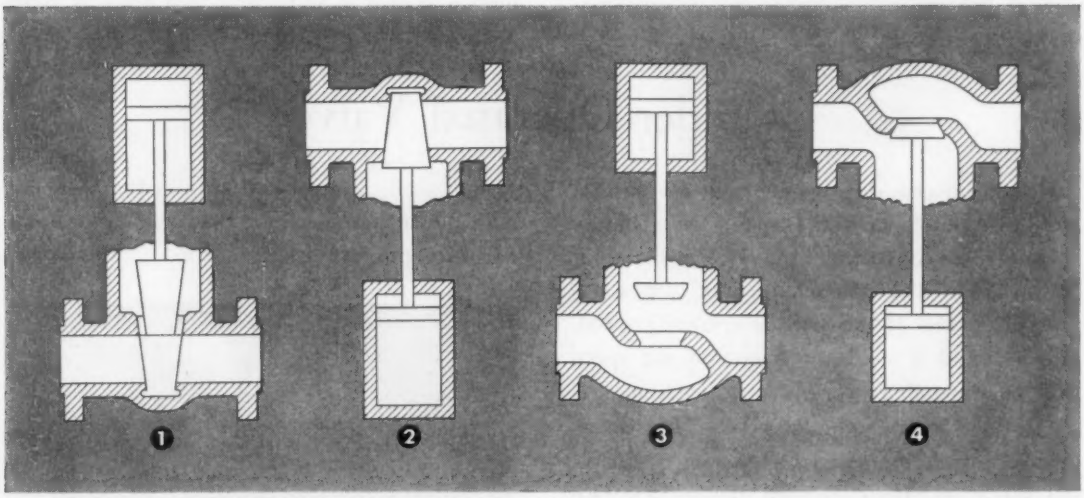
The actuating piping must be carefully sized. If too small, the pressure drop in the pipe and back pressure from the cylinder will result in inadequate pressure for proper operation. Pulsa-



9 CYLINDER OPERATORS such as one shown on valve here are made for both hydraulic and air operation



10 CONTROL PIPING for cylinder operators includes four-way cock and sediment separator. Cock is set to open valve at left and to close it at right. Sediment separator is needed to prevent cylinder damage



11 LOSS OF ACTUATING PRESSURE in cylinder operated valves may cause valve to open or close as shown here. What happens depends upon orientation, friction between stationary and moving components, and other factors described below. Valves 1 and 3 tend to close on loss of cylinder pressure, 2 and 4 tend to open

tions in liquid actuating pressure, such as those caused by a reciprocating pump must be eliminated by air chambers or shock absorbers.

It is imperative that the actuating pressure be uniformly maintained in the cylinder at all times. The difficulties that could result should the pressure fail are shown in Fig. 11 and discussed in detail below:

1) An open gate valve in a horizontal line with the cylinder above, could close automatically unless friction between the stem and the packing prevent it.

2) If in the inverted position with the cylinder below, a closed gate valve could automatically open unless friction between the disc and seats or between the stem and packing holds the disc in place.

3) A globe valve in a horizontal line with the cylinder above and the valve open, could close automatically if the *line pressure* is above the disc. With main *line pressure* acting below the disc, the valve might remain open.

4) If in the inverted position with the cylinder below, and the valve closed, a globe valve could open unless the line pressure is acting on the disc to hold it closed.

To avoid difficulties 1 and 2 above, a gate valve would have to be installed with the stem horizontal, either in a vertical or horizontal line.

Loss of cylinder pressure on a globe valve

might cause a change in the disc position no matter how the valve is installed, even in a vertical line. The main line pressure could control the disc position.

It is necessary to pipe the actuating fluid from both the top and bottom of the cylinder to the four-way valve. This applies also when employing remote control, by locating the control valve away from the main valve. Additional pressure drop will result in remote control installations unless the actuating piping is properly sized.

An extension of the stem projecting through the top of the cylinder is frequently used for visual indication of the disc position.

Specifications for Cylinder Operators

Specifications for cylinder operated valves should include the following information in addition to that covering a regular hand operated valve:

1) The actuating fluid to be used, whether oil, air, or water, etc.

2) Maximum temperature of actuating fluid at the cylinder.

3) Pressure of available operating fluid. The higher the pressure, the smaller the cylinder can be.

4) Maximum working pressure and temperature the valve will be used for.

5) Maximum differential pressure against which the valve must be opened or closed.

6) The desired speed of operation, one inch per second is frequently used. However, the line fluid must be considered because of the possibility of water hammer occurring due to relatively rapid closing of the valve. Here also, air chambers or shock absorbers should be used in the line.

7) Orientation of line (horizontal, vertical, etc.). If horizontal, whether stem will be horizontal or vertical, or other position.

Consider Many Available Accessories

In addition to gearing and power operators, there are numerous accessories which should be given consideration when selecting valves. Those available range from special handwheels to floor stands and extension stems.

Handwheels, Wrenches and Levers

Most valves are equipped with suitable operating means. There are cases, however, where small valves are to be frequently operated and the regular wheel is uncomfortable or hard on the hands. Special wheels, levers, or cross handles, etc., may be more suitable than the wheel furnished. Many such devices are available.

Some manufacturers make special handwheels for large steel valves with built in hammer blow. Gate, non-return, globe, angle, and "Y" valves can be equipped with hammer blow handwheels to facilitate operation of valves in services where the plain handwheel may be insufficient and gearing is not necessary. These handwheels should never be used for small iron body valves.

Larger underground water gate valves are generally made with a square nut on the stem rather than a wheel. Tee-handle socket wrenches in various lengths are available to operate them. These wrenches should be specified to conform to the dimensions of the AWWA standards to properly fit the nut on the stem.

Chain Wheels for Overhead Valves

When a valve is located overhead and out of reach, a chain wheel and chain provide an excellent means for operation (see Fig. 12). For large or high pressure steel valves, it is advisable to use a hammer blow chain wheel. This consists of a lost motion device within the wheel, and is effective either for starting to open the valve or for making a tight seat when closing.

Guides to prevent the chain from jumping out of the groove in the wheel are good insurance against operating trouble, and should be specified, especially when the chains are long. Chain wheels which can be attached to the regular handwheels are also commercially available. When purchasing chain wheels or valves with

chain wheels already mounted, the length of chain required should be specified. Obviously, a valve having a chain wheel must be installed so that the stem or shaft on which the wheel is mounted is parallel to the floor.

Keep Composition Discs on Hand

If composition disc globe, check, or angle valves are used, it is imperative that a supply of replacement discs be kept on hand. A universal disc, one which is capable of giving satisfaction economically in all services, does not exist. Each type of disc is made for a definite purpose. Manufacturers will recommend different discs for various different fluids and for certain maximum temperatures.

Most composition discs have approximately the same dimensions. However, for low pressure service, special small diameter discs are sometimes used. Unless the discs are purchased from the same source as the valve, there may be some difficulty in fitting a disc into the holder.

The most satisfactory method of specifying discs is to indicate the service, including the fluid handled, the working pressure, and the maximum temperature. The kind and size of valve should also be mentioned; preferably by giving the catalog number.

Underground Valve Indicator Posts

Indicator posts are designed for the operation of iron body, non-rising stem gate valves in underground lines. They are commonly used for buried fire prevention lines. For the latter service, the posts must comply with the requirements of the Underwriters' Laboratory, Inc., and the Factory Mutual Laboratory. The Underwriters' Pattern indicator post has some special features not used in standard posts. The body of both the standard and Underwriters' pattern posts are made telescopic to take care of variations in the depth of line bury. The extension stems are made of square rods.

In order to install an indicator post it is necessary to have a flange integral with the valve bonnet, or an adapter plate attached to the bonnet, to which the post can be bolted. Underwriters' Pattern non-rising stem gate valves are made with such a plate integral with the bonnet.

12 CHAIN WHEEL with a guide as shown here provides convenient operation of overhead valves

Specifications for Indicator Posts

If the post is to be made by the manufacturer of the valve, the following information should be given in the specification:

1) Catalog number of post.
2) Catalog number and size of valve.
3) Depth of trench — (distance from bottom of pipe to ground level).
4) Whether valve opens by turning clockwise or counter clockwise.

If the indicator post is to be made by a manufacturer other than the one who made the valve the specification must include the information in items 1 through 4 above and also:

1) Name of valve manufacturer.
2) Number of turns to open valve.
3) Dimensions indicated in Fig. 13.

Use Floor Stands for Convenience

Floor stands provide an excellent means for operating a valve installed under the floor. They are made with or without an indicator to show the position of the valve disc. Although they are sometimes made with gearing, the author rec-

ommends that when gearing is necessary it should be applied to the valve rather than on the floor stand. (See April 1959 HPAC Engineering Data File, p. 154.)

The height of stand, and the available types of finish are sometimes indicated in catalog data.

There are times when the top of a valve will extend through the floor above, but with the wheel too low for convenient operation. In such cases special floor stands can be made, either to be mounted on the floor or attached directly to the valve, depending on the type of valve and the installation.

Floor Stand Specifications

The specifications for a floor stand or a floor stand with extension stem must include the following definite information:

Floor stand only

When it is to be made by the manufacturer of the valve include:

1) Whether indicator is required.

2) Height of stand preferred.

3) Finish, viz. Japanned or finished.

4) Style of valve — non-rising stem gate, or rising stem gate, globe, or angle.

5) Valve size and catalog figure number.

6) Number of turns to open valve (clockwise or counter clockwise).

7) Detailed description for special applications.

8) Whether there will be any movement of the valve due to contraction and expansion of the piping. Universal joints in the stem are required in this case.

Floor stand only

When it is to be made by other than the manufacturer of the valve include:

(1) to (8) inclusive same as those listed above.

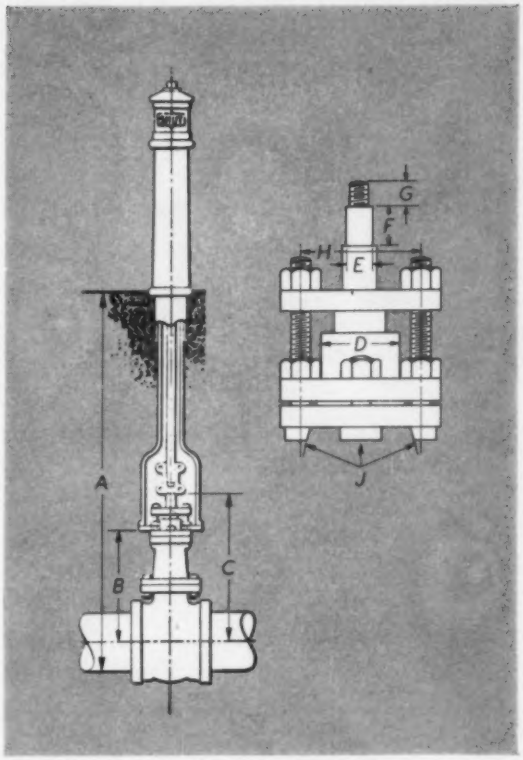
9) Valve manufacturer's name.

10) Diameter of valve wheel.

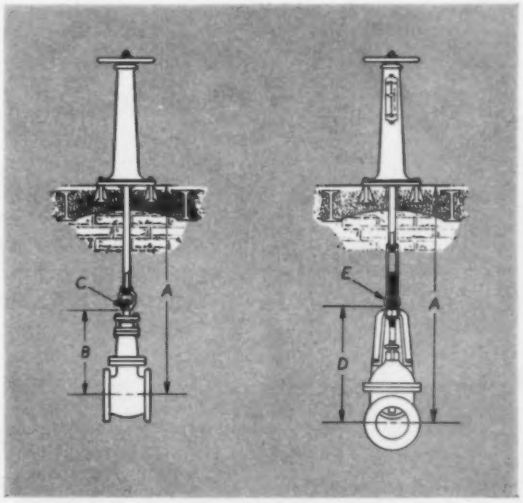
11) If globe or angle valve — distance from center of valve port to top of valve wheel, with valve both open and closed. (This gives the lift of valve disc.)

Floor stand and extension stem

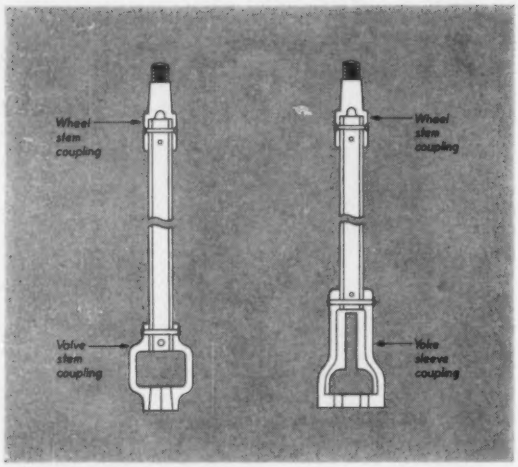
If the stand and extension stem is to be made



13 INDICATOR POSTS are designed for operating underground valves. Important dimensions when specifying are: *A*, depth of trench; *B*, center of pipe to top of stuffing box flange; *C*, center of pipe to bottom of valve stem square; *D*, diameter of stuffing box; *E*, size of stem square; *F*, height of stem square; *G*, length of stem thread; *H*, stuffing box circle; *J*, number and diameter of stuffing box studs and/or bolts



14 FLOOR STANDS with extension stems provide a convenient means of operating valves mounted below the floor. At left is stand and stem for non-rising stem valves. Stand at right is for O S & Y gate valves



15 EXTENSION STEMS for non-rising stem gate, globe, and angle valves at left, and for O S & Y gate valves at right provide means of operating inaccessible valves. Stems are made of extra heavy pipe

by the manufacturer of the valve the specification must include items (1) to (8) above for the floor stand and in addition the following dimension.

12) Dimension *A* in Fig. 14 (center line of valve port to floor).

Floor stand and extension stem

If it is to be made by other than the manufacturer of valve, items 1 to 12 above and the following dimension should be included:

13) For globe, angle, or non-rising stem gate valves; dimensions *B* and *C*, Fig. 14. (*B* is center line of valve port to bottom of stem square, *C* is detail dimension of stem square for wheel.)

For outside screw and yoke gate valves; dimensions *D* and *E*, Fig. 14. (*D* is center of valve port to bottom of valve wheel, *E* is detail dimension of that part of yoke sleeve on which wheel fits.)

Extension Stems for Remote Valves

Extension stems provide means for operating valves in otherwise inaccessible locations. They are generally made of pipe having connection couplings for attaching to the valve and for mounting the wheel (see Fig. 15).

When intended for use with floor stands, it is best to purchase the stand and extension stem as a complete unit from the manufacturer of the valve it is to be used with. This will assure proper asembly connections.

Fig. 15 shows two typical extension stems. When it is impractical to locate the wheel in a position directly in line with the valve stem, extension stems are sometimes made with flexible joints (See Fig. 25, p. 154, April 1959 Heating, Piping & Air Conditioning).

Long extension stems must be rigidly guided and properly supported by brackets and bearings.

As in the case with floor stands, the specifications must include detailed information. In every case, the length of the extension stem, from the center of the valve port to the bottom of the square on the wheel stem coupling at the top of the extension stem, must be stated. In addition, the following data must be included when the stem is to be provided by the manufacturer of the valve:

1) Style of valve — non-rising stem gate, rising stem gate, globe, or angle.

2) Valve size and catalog figure number.

3) Detailed description for special applications.

If the stem is to be provided by other than the valve manufacturer, the specification should include items 1 through 3 above and the following data:

4) Valve manufacturer's name.

5) Diameter of valve wheel.

6) For globe, angle, or non-rising stem gate valves; dimensions *B* and *C*, Fig. 14. For outside screw and yoke gate valves; dimensions *D* and *E*, Fig. 14.

Valve Service Requires Special Tools

Special tools are necessary for servicing valves. The most important of these are the reseating tools. The reseating tools required for gate valves differ from those needed for the globe types. There are a number of companies who specialize in reseating tools.

Seat ring wrenches are also necessary for removing and replacing renewable valve seats. Inasmuch as there is no standard for the grooves or lugs used for removing seat rings, it is obvious that the best source of supply should be the company who made the valves.

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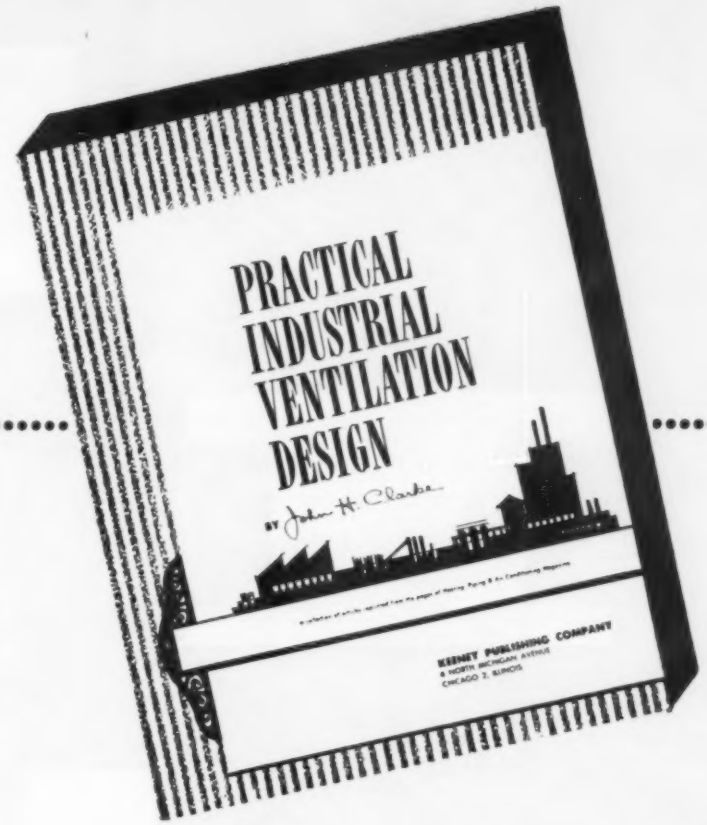

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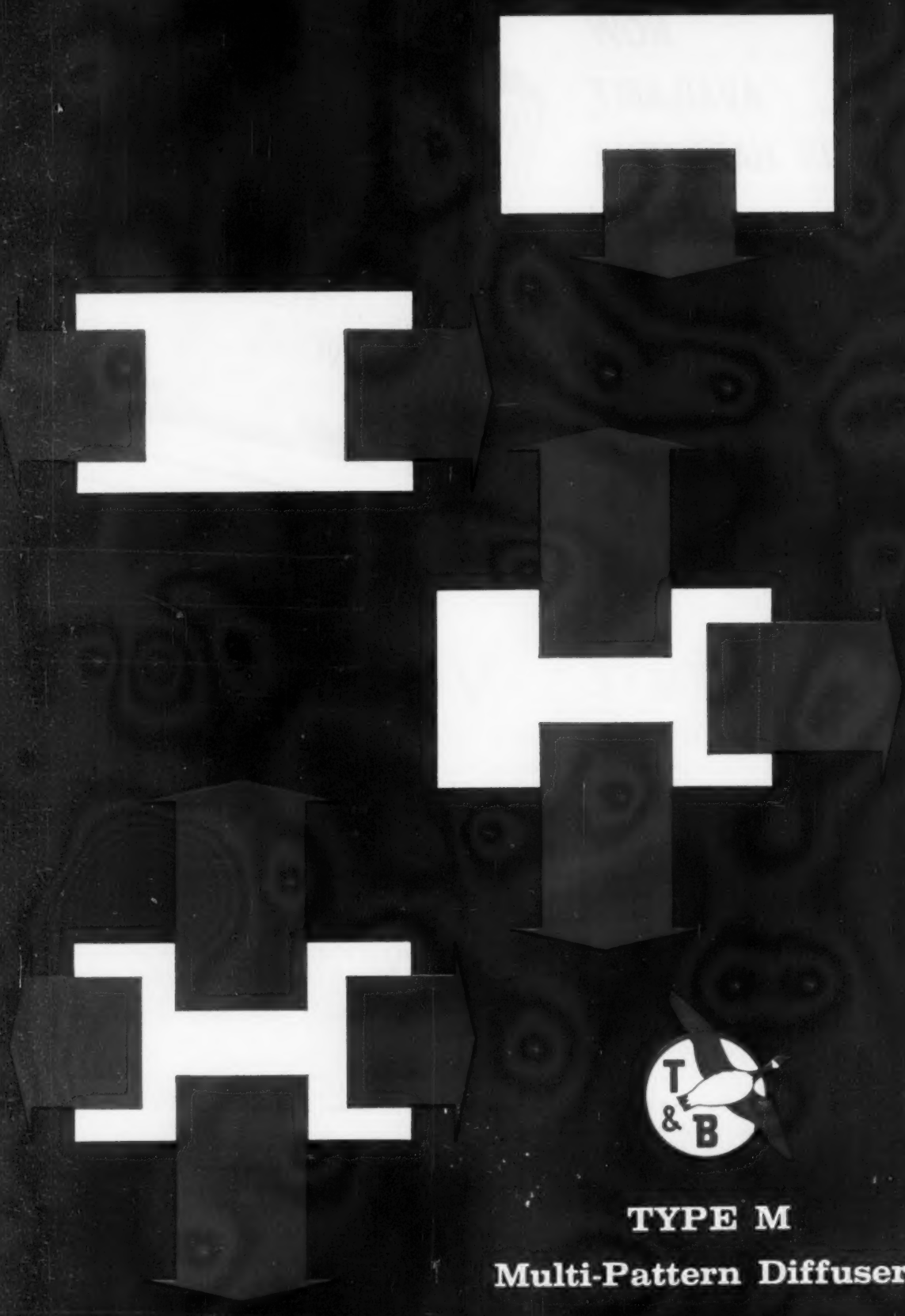

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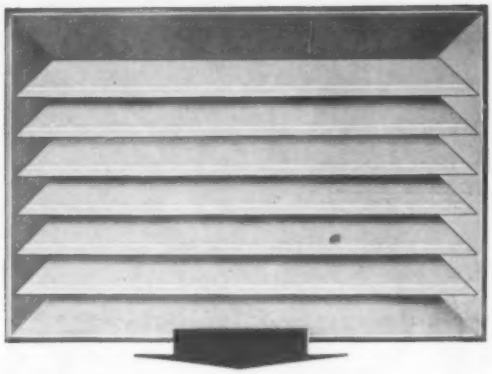
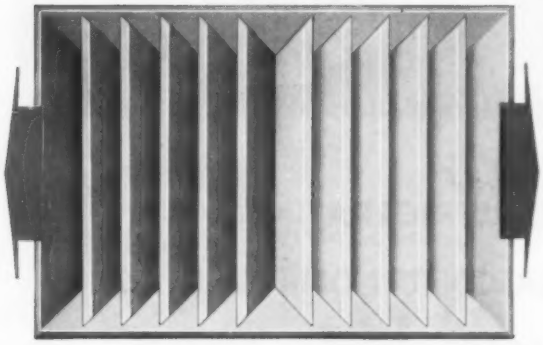
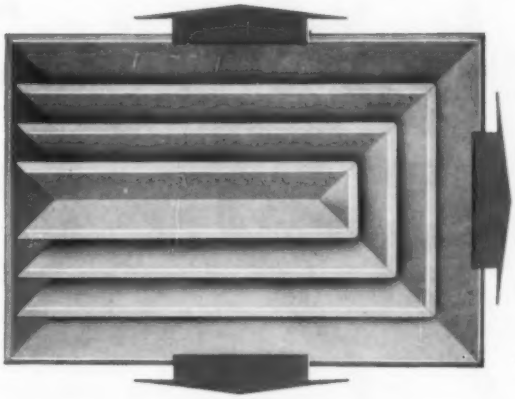
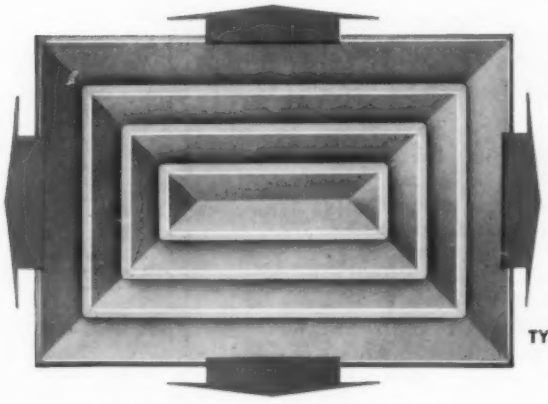


TYPE M 2-WAY BLOW





TYPE M 3-WAY BLOW



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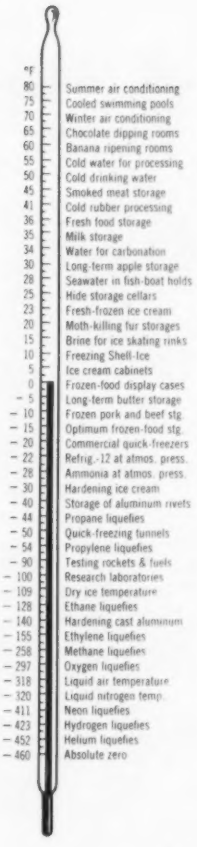
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80 Summer air conditioning
75 Cooled swimming pools
70 Winter air conditioning
65 Chocolate dipping rooms
60 Banana ripening rooms
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50 Cold drinking water
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35 Milk storage
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− 100 Research laboratories
− 109 Dry ice temperature
− 128 Ethane liquefies
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− 155 Ethylene liquefies
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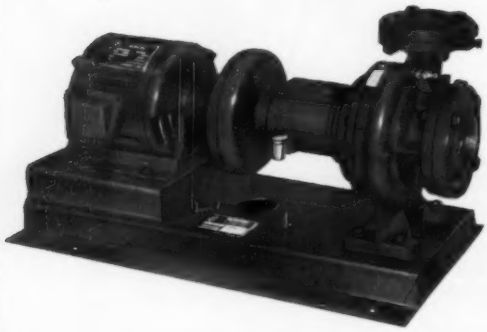
How the REMITE® seal in

B&G® centrifugal pumps

assures leak-proof operation



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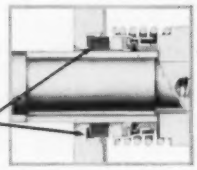

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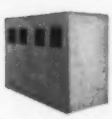
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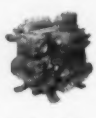
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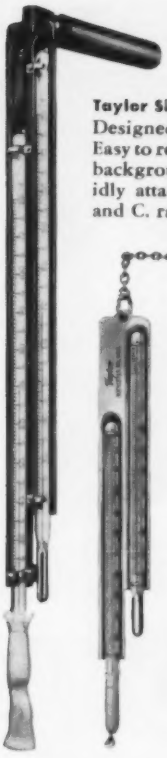
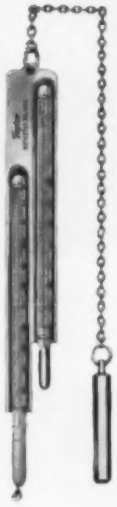
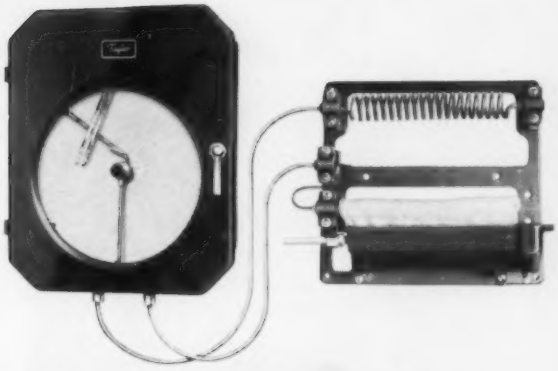


Taylor Sling Psychrometer
Designed for simple, accurate operation. Easy to read, thanks to translucent golden background. Folding swivel handle rigidly attached to metal back. Several F. and C. ranges.



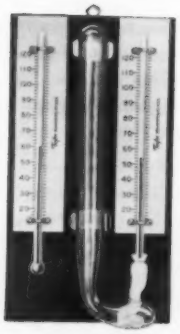
Pocket Sling Type Psychrometer
Sturdy metal mounting only 5″ long for convenience, with sturdy chain and handle. 1° divisions range from 20° to 120°.



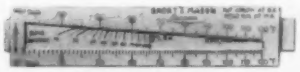
Recording or Recording-Controlling Hygrometer
With bottle or continuous water feed, for applications with good air circulation, where panel is located within apparatus room or duct for best circulation across the bulbs. Or with suction fan where circulation is poor.

Is it the HEAT or the HUMIDITY?

Whatever your recording or control problem, you can rely on Taylor instruments like these. They're accurate, rugged, dependable. For detailed information ask your Taylor Field Engineer or write
Taylor Instrument Companies, Rochester, N.Y., and Toronto, Ont.



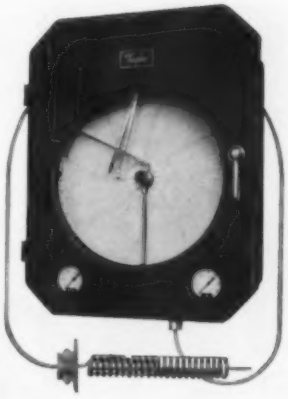
Hygrorule
Does away with need for cumbersome tables by translating wet and dry bulb readings into relative humidity values within 1% of table readings. One side calibrated for sling psychrometers, the other for still-air hygrometers. 6″ long, leather case.



Mason's Form Hygrometer
For wall mounting in office, factory or home. Range from 30° to 220° with black markings on white scale, 8½″ x 4½″, mahogany or gray metal mounting.

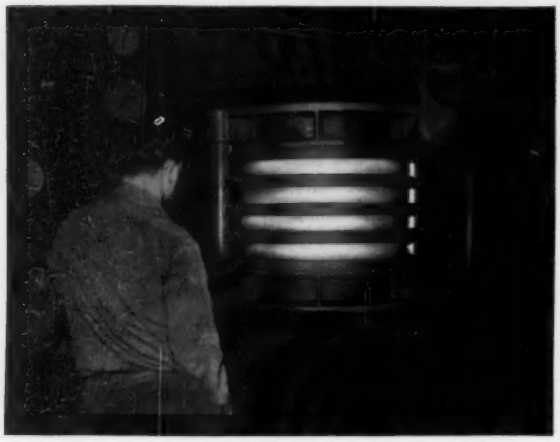
Taylor FULSCOPE* Temperature Controller
Keeps damper motors and diaphragm valves at proper openings for perfect functioning of your air conditioning system. Automatically compensates for load changes. Gives automatic seasonal changeover.

*Reg. U.S. Pat. Off.

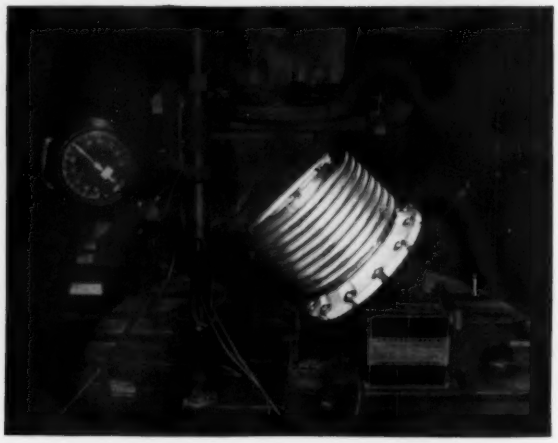


Taylor Instruments **MEAN ACCURACY FIRST**

4 WAYS to get maximum reliability in expansion joints



1 Insist that the corrugated bellows be hydraulically formed. The reason is simple. Whenever bellows are formed by circumferential welding . . . whether by edge, seam or fillet welding . . they will always be subject to premature failure because of stress concentrations at the welds.



2 Be sure the manufacturer maintains a continuous and comprehensive program of endurance testing. This is basic, because of the many variables that affect expansion joint life. Accurate determination of expansion joint life expectancy can only be determined by cycling to destruction.

3 Demand proof that the manufacturer can produce longitudinal welds in the corrugated bellows having the same strength, physical properties and thickness as the parent metal . . . without grinding. A weld that is hard to find is a ground weld. Variations in weld thickness set up points of stress concentration . . . opening the way for premature failure.

4 Check the ability of the manufacturer to supply a team of *competent* design and application specialists to work with your engineers. Check their specific experience in handling critical, complex applications in your field . . . complete to the record of successes or failures behind them, and details of how this experience will be brought to bear on your problem.

At Zallea, none of the many factors affecting expansion joint reliability are left to guesswork . . . including the four vital ones above.

This is reflected in these facts. Zallea material specifications are the most exacting in the industry. Zallea expansion joints are hydraulically formed. Zallea advanced welding techniques insure welds having the same thickness, strength and physical properties as the parent metal. Zallea has done more cyclic testing to destruction than all government agencies and industrial firms combined. Zallea has produced more expansion joints than any other manufacturer . . . offers more application engineering experience.

For all the facts, write for Catalog 56. Zallea Brothers, Taylor and Locust Streets, Wilmington 99, Delaware.

Zallea for maximum reliability

ZALLEA BROTHERS, Wilmington 99, Delaware • World's largest manufacturer of expansion joints

Diagrammatic cross section of pipeline insulated with Witcolite.®

Witcolite is a granulated, resilient adhesive material which is easily installed. After curing, three zones of insulation are formed:
A) **cured zone**—insulating and anticorrosive area locked around pipe. B) **sintered zone**—air-pocketed insulating area...moisture barrier. C) **granular zone**—loose particles providing maximum thermal insulation.

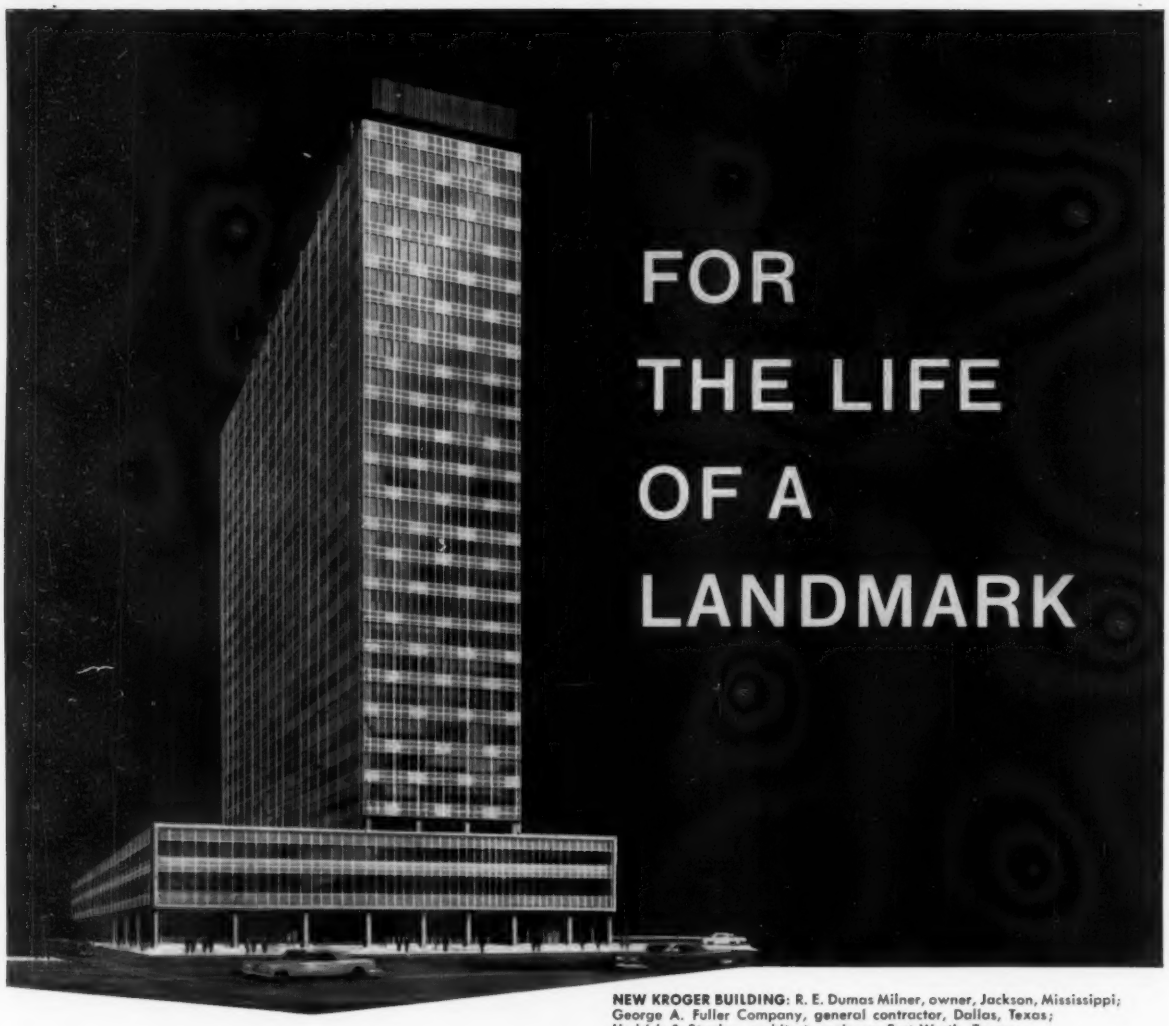
WITCOLITE OFFERS ALL THESE ADVANTAGES

3 LABORATORY-CONTROLLED GRADES of granulated particle size assure perfect high thermal insulation of underground hot pipes...even with pipes alternately conveying hot and cold liquids. **HIGH THERMAL INSULATION** is the result of Witcolite's three zone protection. The product resists physical breakdown and adheres resiliently to pipes as they expand and contract with temperature changes. **HIGH CORROSION RESISTANCE** protects pipes permanently against acids and alkalis found underground. Witcolite is also effective against electrolytic processes. **HIGH WATER RESISTANCE,** results from the surface tension differential between water and Witcolite. No wetting of the underlying surface occurs. **LOWEST COST** of any quality material on an installed basis is an extra plus with Witcolite. *For further information or technical literature on Witcolite, simply write or call the nearest Witco office listed below for your local representative's address.*

Witcolite is delivered to your job site in convenient, easily handled 50 pound multi-wall paper bags.

WITCO CHEMICAL COMPANY, Inc.
PIONEER PRODUCTS DIVISION
Dept. 81-01, 122 East 42nd Street, New York 17, N.Y.

Sales offices: New York • Chicago • Akron • Los Angeles • Toronto and Montreal, Canada



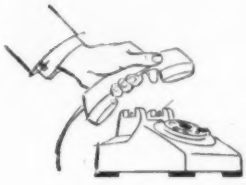
NEW KROGER BUILDING: R. E. Dumas Milner, owner, Jackson, Mississippi; George A. Fuller Company, general contractor, Dallas, Texas; Hedrick & Stanley, architect-engineer, Fort Worth, Texas; Sam P. Wallace Company, mechanical contractor, Dallas, Texas; John F. Deye Company, plumbing and heating contractor, Cincinnati, Ohio.

Sheer Stamina...Thousands of feet of Republic Steel Pipe installed in Cincinnati's new Kroger Building

It was steel pipe for plumbing and heating in this new, Cincinnati, Ohio, landmark.

Based on experience, John F. Deye Company, Plumbing and Heating Contractor, chose 1" through 4½" Republic Continuous Butt Weld ...and 5⁹⁄₁₆" through 12¾" Republic Electric Resistance Weld. The choice assured *uniformly* high workability.

Constant quality control on the part of Republic makes the difference. You feel the uniformity in cutting and threading. You see the uniformity after bending and welding. For complete information, talk to your nearby Republic Distributor. Or, write Republic Steel Corporation, Dept. HP-9579, 1441 Republic Building, Cleveland 1, Ohio.



INSIST ON PIPE MADE IN U.S.A.

CALL YOUR LOCAL REPUBLIC DISTRIBUTOR FOR QUICK DELIVERIES OF

REPUBLIC *Steel Pipe*

With a draft diverter these are
nothing but smoke stacks.
Specify instead a
FIELD DRAFT CONTROL
and they become
true chimneys
. . . an abundant, unfailing source
of draft, precisely controlled to
the needs of gas combustion
field
FIELD CONTROL DIVISION, Conco Engineering Works, Inc. - Mendota, Illinois
AFFILIATES: Spartan Tool Division - Powered Sewer Cleaning Equipment - Material Handling Division - Cranes, Hoists - Conco Building Products, Inc. - Brick, Tile, Stone

Do you check these points When Buying **STAINLESS STEEL** *Valves?*

- ☐ **How good are the castings?**
- ☐ **How precise is the machining?**
- ☐ **How rigid are the inspection and testing?**
- ☐ **How sound is the design?**

Just as important as a suitable stainless steel alloy are these four checks on valve quality. For long, dependable performance, a valve should rate *perfect* on every one.

There's a very good reason why you can be sure Jenkins Stainless Steel Valves will do that, unvaryingly:

For almost a century Jenkins has specialized in making valves. And making them to one standard of quality . . . the highest. Every operation and every worker is aimed at fulfilling that standard. The result is a product that can be backed by this 91-year-old assurance for valve users:

A Fair Offer

If you will put a Jenkins Valve, recommended for your particular service, on the worst place you can find . . . where you cannot keep other valves tight — and if it is not perfectly tight or it does not hold steam, oil, acids, water or other fluids longer than any other valve, you may return it and your money will be refunded.

Order these reliable Jenkins Valves from your local Jenkins Distributor. Ask him or write us for Stainless Steel Catalog No. 59SS. Jenkins Bros., 100 Park Avenue, New York 17.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864 Jenkins Bros

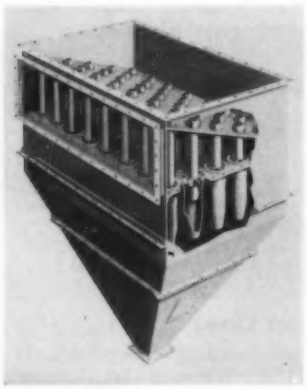
Sold Through Leading Distributors Everywhere

EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see page 207

Cooling Towers . . .

. . . in series of 1, 2, and 3-cell models with fan diameters from 120 to 168 in., designed to complement line of smaller units and custom designed towers, feature broad sloping louvers, glass reinforced polyester grid fill supports; towers utilize open gravity water distribution system, combined mechanical equipment support and hot water lateral, external lubrication lines on gear drives; several piping options available; bulletin "DFA 15-60" available from manufacturer—*The Marley Co., 222 West Gregory, Kansas City 14, Mo.*



Dust Collector . . .

. . . cyclone separator type, features compact design, choice of duct connections, variety of tube arrangements; of all steel construction, with cast 9 in. diameter tubes and vanes or special materials for individual requirements; available as a standard unit in several types, has high efficiency over broad range of dust particle sizes, according to manufacturer—*John Wood Co., Air Pollution Control Div., Essex Bldg., Bernardsville, N.J.*

Centrifugal Pump . . .

. . . of vertical design for hot and cold water, condenser water circulating, other applications, features flexible coupling between motor and pump with mechanical shaft seal; pump may be removed from casing without disturbing piping connections, is rubber mounted for vibration isolation; for capacities to 600 gpm, discharge heads to 110 ft; bulletin "VKY-6900B" available upon request—*Weil Pump Co., 1530 N. Fremont St., Chicago, Ill.*

Electric Motors . . .

. . . with NEMA type "C" face mounting for use on pumps, propeller-type fans, other applications, available in 1 through 5 hp models at 1800 rpm, ¾ through 3 hp at 1200 rpm, ½ through 2 hp at 900 rpm; design said to reduce length of motor by as much as 7 in., weight by as much as 20 percent from earlier models—*General Electric Co., 1 River Rd., Schenectady 5, N.Y.*

Induction Unit . . .

. . . for under-the-window installation in high-velocity systems features built-in device to control air flow through the cooling-heating coil, with water flow remaining constant; obviates need for separate water controls in some cases, according to manufacturer; water flow controls may be installed if desired; unit has discharge grilles locked in place to prevent tampering, plus redesigned cooling coil arrangement permitting easier cleaning from the front; in six models, five nozzle arrangements —*Carrier Corp., Carrier Pkwy., Syracuse 1, N.Y.*

Centrifugal Blowers . . .

. . . with airfoil blades, single or double inlet, in 15 sizes, AMCA Class I through III; "radial rim wheel" design allows for minimum turbulence due to relatively low velocity of air over blades, according to manufacturer; blower inlets are aluminum or steel, blades of die formed steel with formed steel and bar stiffeners —*American Standard Industrial Div., Detroit 32, Mich.*

EQUIPMENT DEVELOPMENTS
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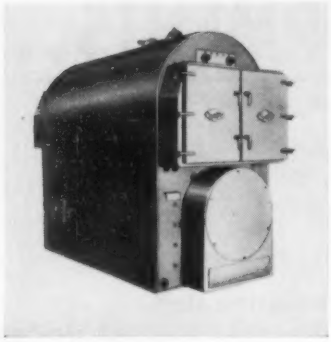


Industrial Boilers . . .

. . . in 88 sizes and models for large commercial, institutional, and industrial heating range in size from 1780 through 64,280 sq ft steam, in gas and oil fired models; line includes three series: low water line, horizontal fire tube and Scotch type, feature new door designs, increased combustion efficiency, according to manufacturer; units are available either factory assembled or for assembly at job site—*Federal Boiler Co., Inc., Granite and West Sts., Midland Park, N.J.*

Grilles . . .

. . . featuring horizontal curved louvers, for air conditioning, return air, ventilation, and combustion air requirements, according to manufacturer, in size ranges from 10 × 6 in. up to 30 × 24 in.; 30 deg louver deflection prevents see-through, entire grille is of steel; units are designed for high sidewall, low sidewall, ceiling, or door installation—*Lima Register Co.*, 1790 *N. Cable Rd., Lima, O.*

Gate Valves . . .

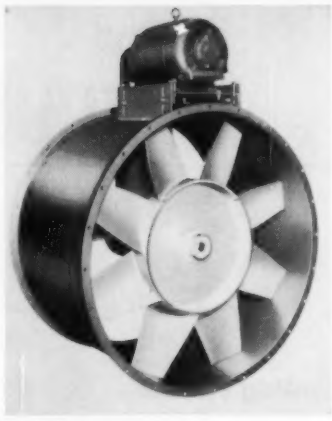
. . . steel, 150 and 300 lb, with flexible wedge disc; working pressure for 150 lb valve is 40 psi at 1000 F up to 275 psi at 100 F; 300 lb valve range is 85 to 720 psi at similar temperatures; disc consists of two halves, with axle-like connector; slight flexing said to provide tight seal in inlet and outlet faces, ease of opening, compensation for minor misalignment of seats due to pipeline deflections according to manufacturer—*Crane Co.*, 836 *S. Michigan Ave., Chicago* 5, *Ill.*

Liquid Analyzer . . .

. . . for automatic measurement of trace quantities of insoluble solids in liquids such as boiler feedwater, condensate, process liquids, etc., said to be capable of detecting two parts impurity in billion parts liquid; uses filter tape to collect impurities from predetermined test sample on automatic cycle, operates on single phase, 110-115 v 60 cycle current with flow rates of 0.1 to 0.5 gpm at 50 to 100 psi—*Graver Water Conditioning Co.*, 216 *W. 14th St., New York* 11, *N.Y.*

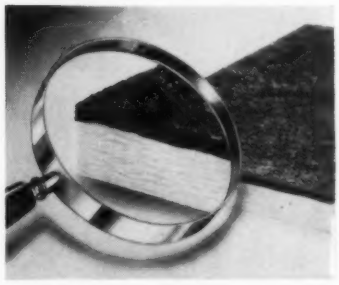
Air Filter . . .

. . . of glass fiber for high efficiency air filtration applications; medium is available in sizes to 72 in. wide, 100 or 200 ft rolls, or lengths to specification—*Owens-Corning Fiberglas Corp.*, 717 *Fifth Ave., New York, N.Y.*



Axial Flow Fans . . .

. . . belt drive, in 30 to 60 in. sizes, up to 85,000 cfm, feature bearing assembly suitable for loads to 50 hp, standard or high pressure propellers, aluminum-magnesium alloy cast airfoil blades; for use in temperatures to 350 F or for higher temperatures with special material bearings, special interior coatings also available for corrosive or abrasive exhaust air requirements—*Robbins & Myers, Inc., Propellair Div., Springfield, O.*



Duct Liner . . .

. . . of two-part construction, in ½, 1, 1-½, and 2 in. thicknesses, consists of outer glass fiber layer of high density to resist air velocities of up to 500 fpm, backed by lighter density with better sound and thermal insulation properties; layers have 0.60 and 0.80 noise reduction coefficients respectively, entire liner has thermal conductance of 0.25 at 75 F, according to manufacturer; insulation is available in 24, 36, 46-½, and 48 in. widths, 50 to 200 ft rolls—*Johns-Manville, Industrial Insulations Div.*, 22 *E. 40th St., New York* 16, *N.Y.*

U. S. ROYAL V-BELTS from the Power Unlimited complete belt line

Forget your experiences with V-Belts on air-conditioning units

The U. S. Steel Cable V-Belt has everything required in a belt for air-conditioning use. Here is a V-Belt that's in a class by itself. It is equipped with pulling members of steel. A new patented curing method and electronic tensioning of the steel cords free this belt from vibration. It transmits power smoothly, quietly and efficiently – and in present automotive air-conditioning service lasts 1½ to 2½ times longer than any other V-Belt. Here are the unequalled advantages the engineers point out:

- All-steel cable members lie in the same plane.
- Wire cable members are straight, never wavy.
- Absolute uniform top width and belt thickness for better seating in pulley.
- Perfect dynamic balance.
- Use of knurled mold insert provides maximum traction and alignment of outside idler.

Our transmission belt field engineers stand ready to consult with you on any or all V-Belt problems. Drop us a line at address below. . . .

When you think of rubber, think of your "U.S." Distributor. He is your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

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WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

EQUIPMENT DEVELOPMENTS
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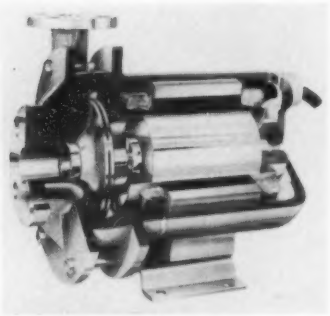
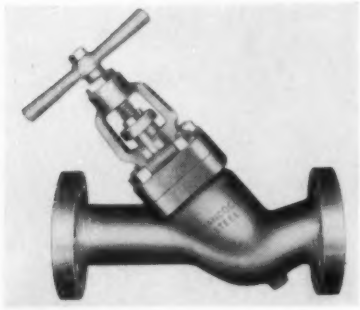


Pump-Motor Unit . . .

. . . designed for dangerous or expensive fluid handling is self-contained, with pump impeller connected directly to motor shaft; unit is encased in stainless steel, pumped fluid circulates within the motor and provides lubrication; wettable parts of pump are also stainless steel; available in ½, ¾, and 1 hp models with capacities to 63 gpm—*Robbins & Myers, Inc.*, 1345 *Lagonda Ave., Springfield, O.*



Boiler Valves . . .

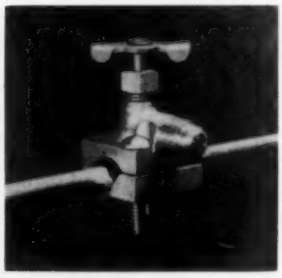
. . . in staightaway and angle types for blow-off and drain applications feature "blow deflector" seat disc design which keeps seating surface of disc out of line of flow; in open position, neither seat nor disc surfaces are affected by flow, according to manufacturer; disc and seat are faced with stellite, stainless steel is used for packing glands, swing bolts, nuts and pins; with bolted bonnet, available in 300 and 600 lb classes, 1 ½, 2 and 2 ½ in. sizes; bulletin "235" available upon request—*Manning, Maxwell & Moore, Inc.* 250 *E. Main St., Stratford, Conn.*

Btu Meter . . .

. . . for assessment of heating or cooling costs on basis of recorded consumption, measures volume or weight of fluid and temperature differential between entering and leaving fluid; units employ electrical resistance thermometers and turbine type flow meters with electromechanical computer; accessories include remote counter, strip chart recorder, separate control panel for activation of external circuits—*Air Conditioning Equipment Corp.*, 219 *E. 44th St., New York* 17, *N.Y.*

Pipe Insulation . . .

. . . designed to prevent corrosion of underground piping, system consists of primer compound for use when insulation is applied under low temperature conditions, putty-type compound for filling irregularities, pressure sensitive polyethylene tape, and sheet material in roll form for shielding protection of under layers; price lists, coverage tables, expository information available upon request—*Chase & Sons, Inc.*, 26 *Spruce St., North Quincy, Mass.*

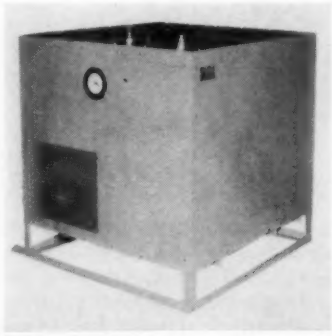


Piercing Valve . . .

. . . for copper tubing from 3/16 through ⅝ in., designed as permanent access valve on hermetic units; of all brass construction, unit straddles tubing and clamps with two screws; key-type handwheel allows installation of tap from top of valve —*Superior Valve & Fittings Co.*, 1509 *W. Liberty Ave., Pittsburgh, Pa.*

Radiant Heater . . .

. . . for infra-red spot heating in wide variety of vented or unvented applications, features circular burner head enclosed above saucer-shaped ceramic coated radiating surface; unit operates from either 24 v thermostat or from wall switch, with gas inputs ranging from 24,000 to 48,000 Btu per hr—*The Solarflo Co., Box* 745, *Glendora, Calif.*



Air Dryer . . .

. . . for compressed air-pneumatic controls application utilizes two cast aluminum heat exchangers and centrifugal stripper to lower dew point of compressed air line to approx 0 F; 36 in cube unit is designated for use at ambient temperatures of 40 to 140 F, uses hermetically sealed compressor for refrigeration system—*Drayer-Hanson Div.*, 3301 *Medford St., Los Angeles* 63, *Calif.*

CLEAN AIR BY AAF in Seattle's newest skyscraper

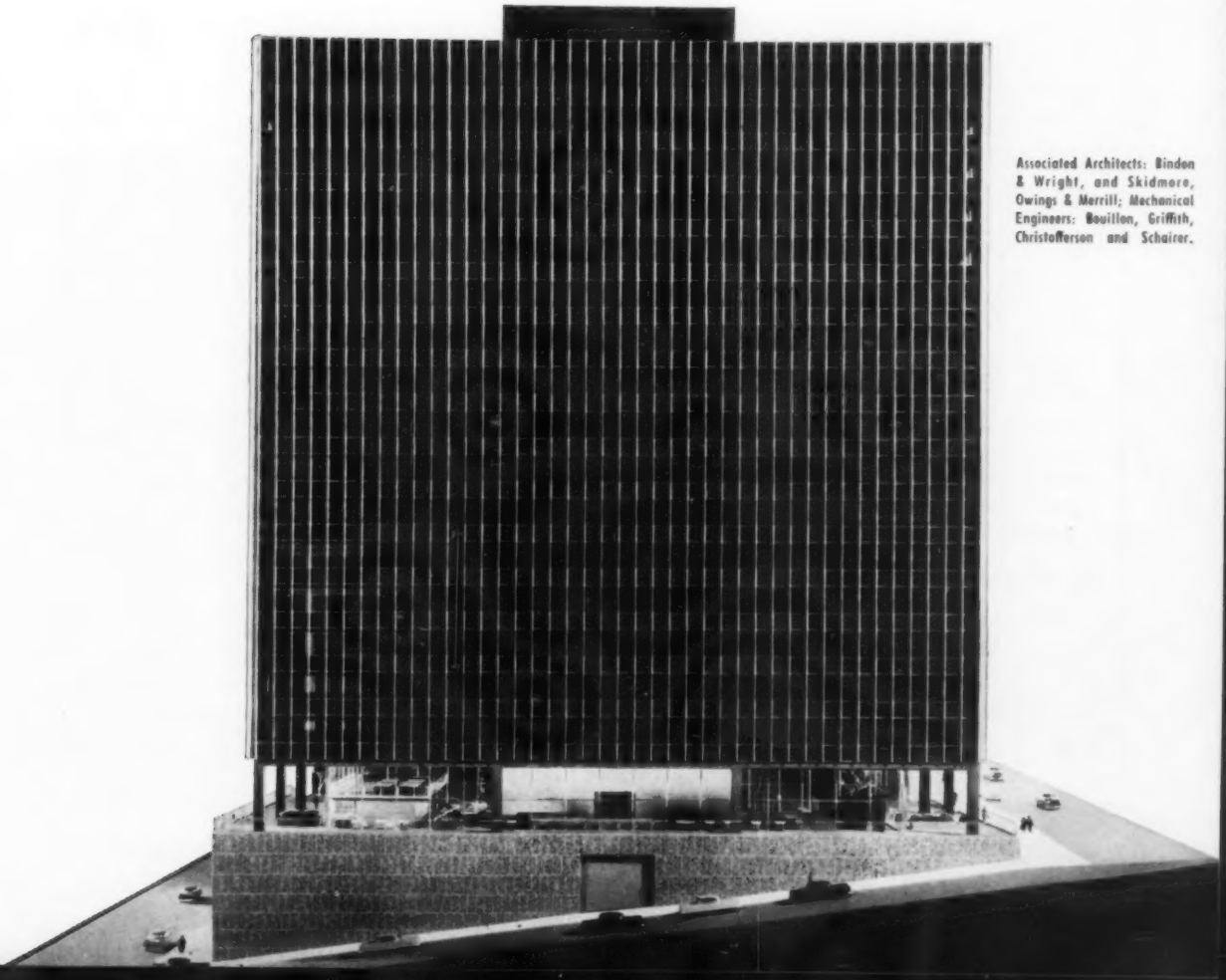
Roll-O-Matic filters selected for impressive new structure

Newest member of the Seattle skyline is the 21-story, glass-and-aluminum Norton Building. Nothing was spared in the effort to make this the most modern, most pleasant office building in the Pacific Northwest.

Throughout this expansive building, the air is filtered for dust-free cleanliness. To make sure they got the air-cleaning efficiency they needed plus the maintenance characteristics they wanted, the builders turned to AAF—the *one* company that makes *all kinds* of filters.

From the complete AAF line, they selected the Roll-O-Matic. These filters are completely automatic, need no attention other than annual replacement of the media roll – an operation as simple as changing the film in a camera. For more product information, call your local AAF representative or write direct for Roll-O-Matic Bulletin 248. Address Mr. Robert Moore, American Air Filter Company, Inc., 373 Central Avenue, Louisville, Kentucky.

AAF **American Air Filter**
BETTER AIR IS OUR BUSINESS



Associated Architects: Bindon & Wright, and Skidmore, Owings & Merrill; Mechanical Engineers: Bouillon, Griffith, Christofferson and Schairer.

YOUR NAME HERE

CUT 20" CAST IRON PIPE *in Less Than 8 Minutes...*

...with the New REED ROTARY CUTTERS

(4 sizes cover the range from 10" cast iron to 26" steel pipe)

These one-man Reed Rotary Cutters cut large diameter steel or cast iron pipe *faster and better than the heaviest power machines* . . . and without electrical or explosive hazards. What's more, there's less digging in ditch-work! You need only a 4" to 6" channel under the pipe and a 45° to 60° arc for the handle swing. Reed Rotaries are easy to "carry in", too. The 20" size weighs only 68 pounds; separates into 3 easily carried parts. Patented pipe guide assures clean, right-angle cuts. Four razor blade wheels track perfectly, cut easily and are quickly interchangeable for steel or cast iron pipe.

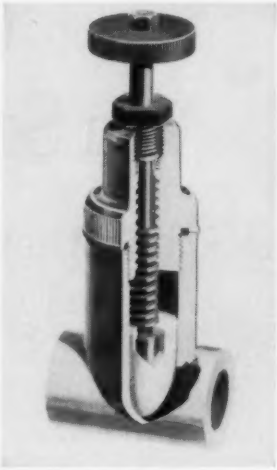
- Write today for descriptive literature.

These typical cuts on 12, 16, 20 and 24" cast iron pipe illustrate the clean, accurate, right-angle cuts provided by Reed Rotary Cutters.

REED MANUFACTURING COMPANY
ERIE • PENNSYLVANIA

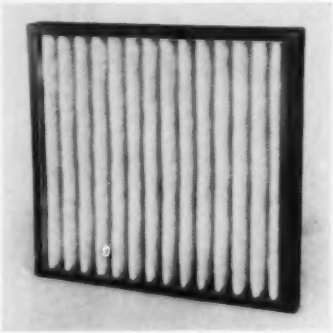
EQUIPMENT DEVELOPMENTS

Continued



Plastic Gate Valves . . .

. . . for corrosive fluid handling said to provide resistance to most solvents, greases, oils and common acids at temperatures up to 185 F; available in sizes from ½ to 2 in., with socket-weld, flanged, or screwed ends—*Vanton Pump and Equipment Corp., Hillside, N.J.*



Disposable Filters . . .

. . . consisting of 2 in. high pleats set on 1¼ in. centers; air stream forces each pleat into parabolic shaped pocket; manufacturer states heavier dirt particles collect on center or "back" surface of pocket, lighter particles on sides; medium is uncoated, fire resistant, adaptable to all types of filter banks; bulletin "601-ES" available upon request—*Arco Mfg. Corp., 542 W. 55th St., New York 19, N. Y.*

ONE pump becomes MANY . . . saving you pump dollars . . . giving you a wide range of clear water, non-clog and other liquid-handling modifications . . . when you standardize your pumping operations with Fairbanks, Morse ADAPT-*ABLE* pumps.

F-M ADAPT-*ABLES* consist of a pump frame and simple adapter to which can be attached a wide variety of F-M hydraulic ends with enclosed, semi-open or non-clog impellers. Conversion is easy . . . inexpensive, too.

F-M ADAPT-*ABLES are "NEMA-Matched":* pump mounting dimensions are standardized with similar dimensions of Nema-driving motors. Gone is the need for make-shift height-adjusting blocks and odd-bore couplings!

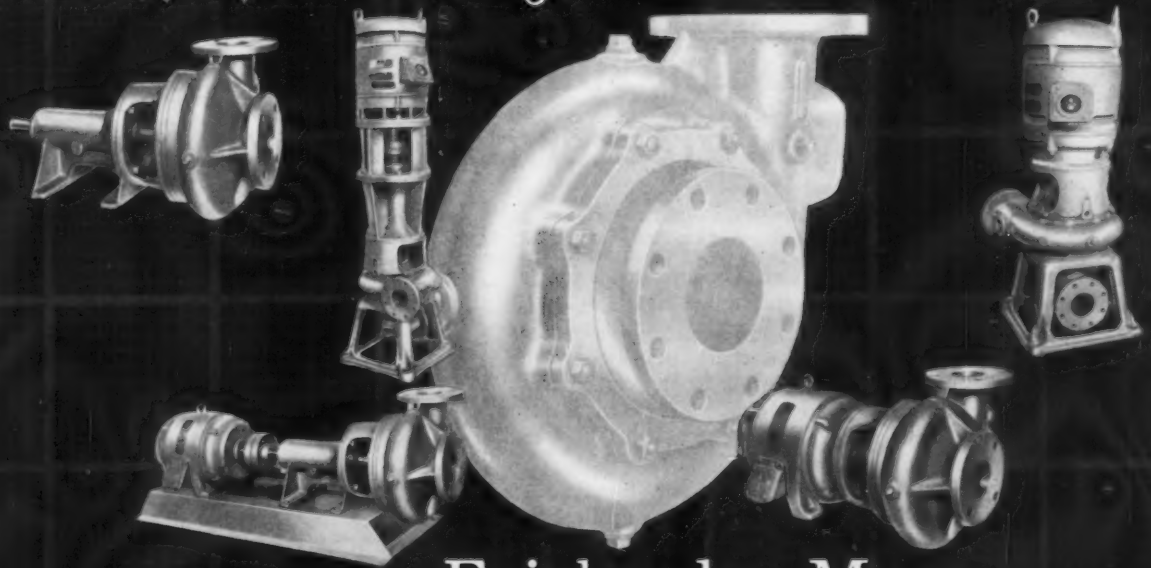
The ADAPT-*ABLE* design means that the most economical frame size may be selected to match the motor horsepower requirements of the pumping job.

And there are other advantages: choice of mechanical seals or conventional stuffing boxes with easy field change-over from one to the other . . . interchangeable bearings for pumps and motors. For special liquid handling problems, hydraulic ends can be specially alloyed to fit the needs: we've been solving such problems for generations.

Regardless of *what* liquids you pump . . . or *where* . . . Fairbanks, Morse builds pumps and *matching* power units for *your* use . . . in a greater range of sizes, types and capacities than *anyone, anywhere.* Start SAVING pump and motor dollars by putting F-M's vast hydraulic experience to work in your plants, process lines and products . . . now!

"nema-matched" *adapt-ables*

. . . a lot of pumps in ONE package!

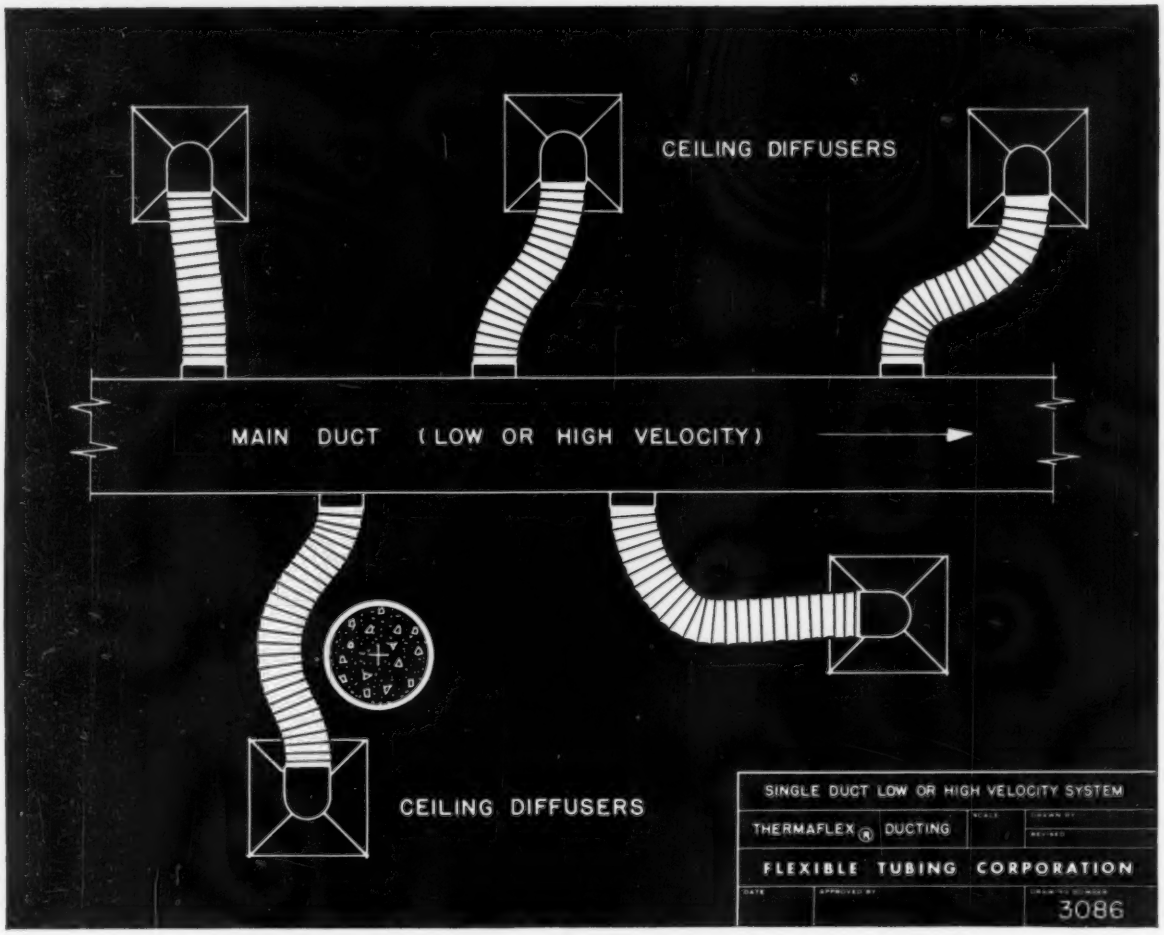


Fairbanks, Morse

THE PROUDEST NAME IN PUMPS

Pump and Hydraulic Division • Kansas City, Kansas

A MAJOR INDUSTRIAL COMPONENT OF FAIRBANKS WHITNEY CORPORATION



For single diffuser take-offs . . .

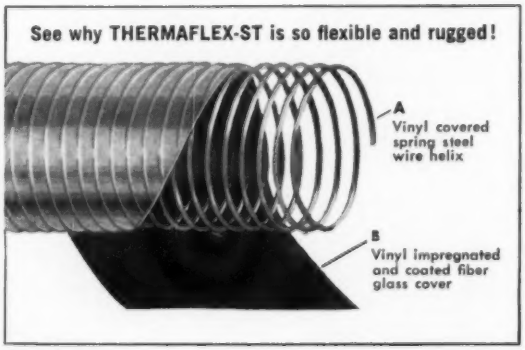
Flexible Tubing simplifies connections . . . gives you greater design flexibility

Flexible Tubing is the fast, easy way to connect supply ducts to diffusers in both low- and high-velocity systems.

This highly flexible duct is ideal for connecting individual diffusers directly to main supply ducts in any installation where you have single diffuser take-offs. Flexible Tubing can go over pipes, wires, beams . . . through tight passages . . . even around sharp corners! . . . in gradual, gentle bends with minimum air flow loss.

Moreover, Flexible Tubing reduces noises and vibration . . . corrects for misalignment at points of take-off. It's lightweight, rugged, flameproof, moisture- and abrasion-resistant!

Take advantage of this remarkable product's great flexibility in the next system you design. For complete product data on Underwriters'-approved Thermaflex®, write to Flexible Tubing Corporation, 57 New Whitfield Street, Guilford, Connecticut.


See why THERMAFLEX-ST is so flexible and rugged!
A
Vinyl covered spring steel wire helix
B
Vinyl impregnated and coated fiber glass cover

Flexible Tubing
CORPORATION
GUILFORD, CONNECTICUT
Anaheim (Los Angeles) • Hillside (Chicago)

EQUIPMENT DEVELOPMENTS

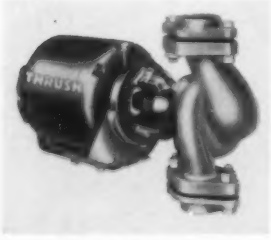
Continued

Disposable Filters . . .

. . . in three interchangeable cartridges with three atmospheric efficiency ranges, 35 to 95 percent; with glass fiber medium or cotton fabric in lower efficiency range model; cartridges are flame-proofed; bulletin "B-1300-4" available upon request—*Farr Co., P. O. Box* 90187, *Airport Station, Los Angeles* 45, *Calif.*

Fluid Filter Membrane . . .

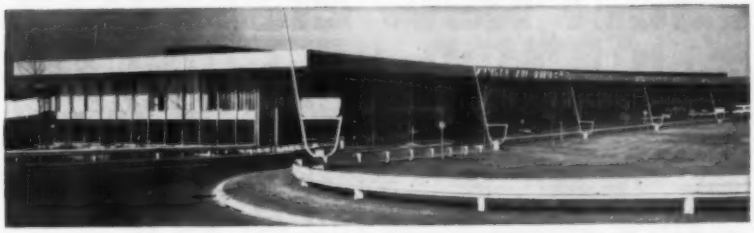
. . . of regenerated cellulose with network of submicron pores said to remove particles as small as 0.1 micron, for standard filtering use or for removal of particles for analysis; will not discharge fibers to contaminate fluid because of solid composition, according to manufacturer —*Gelman Instrument Co.*, 106 *N. Main St., Chelsea, Mich.*



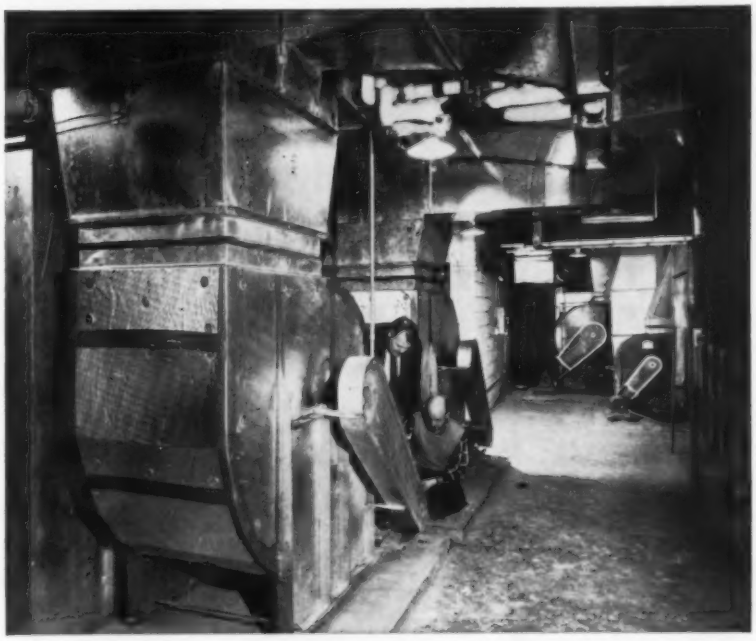
Water Circulator . . .

. . . with bronze body can be used for ¾, 1, 1-¼, and 1-½ in. lines by means of interchangeable flanges; features spring coupling, thermally protected motor, ceramic water seal, easy lubrication through oil cup mounted atop bearing bracket—*H. A. Thrush & Co., Peru, Ind.*

ANOTHER PEERLESS ELECTRIC SPECIAL BLOWER APPLICATION



United Air Lines Terminal Building, Idlewild Airport. Architects: Skidmore, Owings & Merrill. Consulting Engineers: Syska & Hennessy, Inc. General Contractors: Humphreys & Harding. Mechanical Contractors: A. D. Walker & Co., Inc.



Four of the 52 Peerless Electric Blowers. Shown are Philip M. Larkin (left), Senior Project Engineer, and Warren Dorrman (right), Project Supt. of A. D. Walker & Co., Inc.

"COMPLEX AIR HANDLING PROBLEMS MET BY PEERLESS ELECTRIC BLOWERS"

—*Philip M. Larkin, Senior Project Engineer*

Excessive heat transmission from an 800′ long, 20′ high glass front makes difficult the design target of 78° F maximum summer temperature with 50% relative humidity. In winter the need is for 65-70° F with humidity low enough to avoid condensation. Variations cannot exceed a minus 2% in temperature or plus 5% humidity. And the complete system must serve 45 different areas of the building, including the kitchen.

Tight space conditions and aircraft fumes added to the installation problem. The solution: 52 Peerless Electric Fans to supply and exhaust the 175,000 square foot building area. Peerless Engineers worked closely to make possible the necessarily delicate air balance.

No matter how complex your next job, let Peerless Electric engineer your air moving needs. Write: *Peerless Electric Division, H. K. Porter* Company, Inc., W. Market Street, Warren, Ohio.

PEERLESS ELECTRIC DIVISION PORTER H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Just How Clean is clean Air

How clean must the air be in Commercial and Industrial Air Conditioning Systems

How can the specific clean air requirements be achieved in–

Hospital Operating Rooms
Computer Ventilating Systems
Process Exhaust Systems
"Dust-Free" Rooms

. . . and what is the POSITIVE, low-maintenance way to get it

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732 E. Erie Blvd., Syracuse 1, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

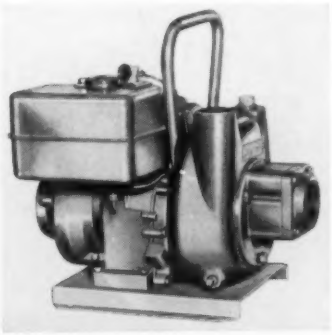
EQUIPMENT DEVELOPMENTS
Continued

Gate Valve . . .

. . . for high pressure liquid and gas or high vacuum applications, with solid wedge, inside screw design, O-ring seals which will not dry out under vacuum, according to manufacturer; literature available upon request—*Jerome Hydraulics Co., Inc., 208 E. Second St., Mineola, N.Y.*

Insulation Adhesive . . .

. . . for duct liner applications is non-flammable when wet, fire resistant when dry, according to manufacturer; tack time when brushed on metal is said to be 6 to 8 minutes; non-freezing material can be shipped in any season—*Goodloe E. Moore, Inc., 2811 N. Vermillion, Danville, Ill.*



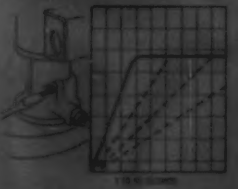
Utility Pump . . .

. . . portable, with internal combustion engine, for discharge up to 7000 gal per hr; self-priming, with built-in check valve; features removable suction plate for easy inspection and impeller cleaning; in two sizes, 1½ or 2 in. suction—*The F. E. Myers & Brother Co., Ashland, O.*

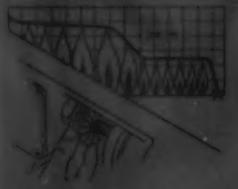
CONTROL – Full modulation provides steady boiler pressure (or furnace temperature) in response to changes in load. Variable speed of response eliminates "hunting" action.

EFFICIENCY – Proper fuel/air mixture is maintained throughout full throttling range of the valve. This means efficient, fuel-saving combustion for ALL firing conditions.

SAFETY – Quick-closing safety shut-off responds readily to high limit controls. Magnetic pilot valve overrides proportioning action.



DEPENDABLE STARTS – Opening speed is adjustable for best possible ignition and pickup. You get safe, sure starts.

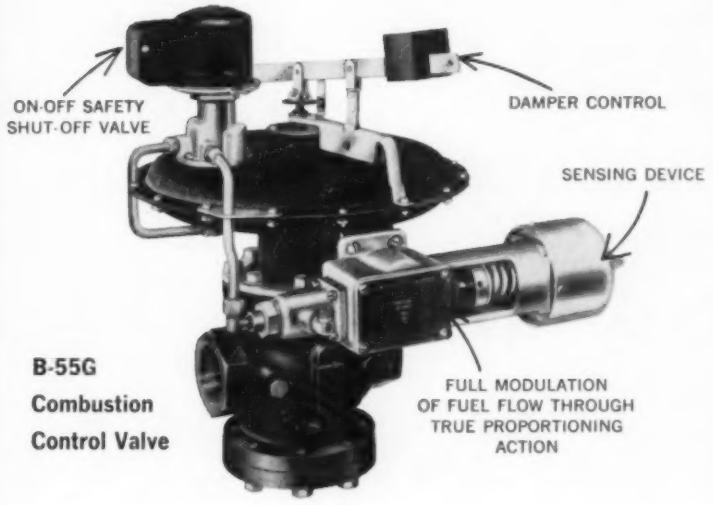


NO PUFF-BACK – Low-fire position is adjustable for boiler "idling" at safe minimum flame. Quick closing action prevents flame flutter and dangerous puff-backs.

LOW COST – Easier to install, reduces maintenance time and costs, simple to operate and costs

for gas-fired boilers and furnaces...

A COMBUSTION CONTROL SYSTEM-*ALL IN ONE VALVE!*


ON-OFF SAFETY SHUT-OFF VALVE
DAMPER CONTROL
SENSING DEVICE
FULL MODULATION OF FUEL FLOW THROUGH TRUE PROPORTIONING ACTION

B-55G Combustion Control Valve

1. **Fuel Proportioning**
2. **Pressure or Temperature Sensing**
3. **Damper Control**
4. **Fuel Shut-Off**

Check the features to the left – then compare them item for item against *any* comparable combustion control system on the market. And to save yourself time and money, do it *before* you do that next installation or change-out. You'll find feature for feature, dollar for dollar, the General Controls B-55G is the best buy, every time. Immediate response to load changes in steam, hot water, or warm air systems – pressure and temperature ranges to 600 psi and 700°F. Sizes 1" to 6". Fully approved by AGA and UL. Let us send you complete information – or check the yellow pages for your nearest General Controls Factory Branch Office.

GENERAL CONTROLS

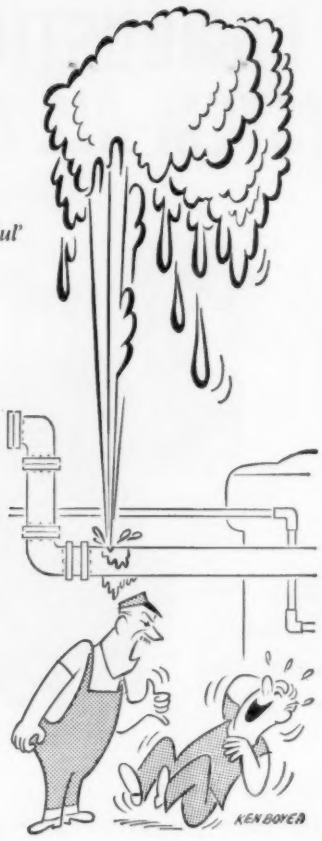
Automatic Controls for Product or Process

Glendale, Calif. · Skokie, Ill. · Guelph, Ontario, Canada

Nine Plants — 44 factory branch offices serving the United States, Canada and Western Europe

Life in these excited states...

"Stop saying 'There goes Old Faithful' and get it fixed!"



What to do when corrosion sends costs sky high

No one can afford ruined equipment, endless repairs, and plant shut-downs caused by corrosion. And you *shouldn't* afford *over*-design and too-fancy equipment. Ace takes you right down the middle . . . a wide choice of chemical-resistant pipe, pumps, valves, tanks, etc. Best for the money anywhere . . . backed by 108 years' experience.

Best non-metallic pipe anywhere for *hot* chemicals to 275°F. Also handles tough organics. Rigid, tough nitrile. Pipe and fittings to 8". *Bul. 96A.*

1001 uses. Non-toxic, odorless, tasteless, sterilizable, flexible tubing. Excellent for chemicals, foods, and for lab or machine lines. ⅛ to 1¼". *Bul. 66.*

Heavy Ace rubber and plastic tank linings unexcelled for alkalies, acids, bleaches, salts. Faultless seams, indestructible bond, shock and age-resistant. All shapes. *Bul. CE-53.*

Special equipment often can be machined, punched or welded of standard plastic or hard rubber sheet, rod or tubing. Write for details today.

ACE *chemical resistant equipment*
BY **AMERICAN** HARD RUBBER COMPANY
DIVISION OF **AMERACE** CORPORATION
ACE ROAD • BUTLER, N.J.

See ACE equipment in Chemical Engineering Catalog

EQUIPMENT DEVELOPMENTS
Continued

Industrial Thermometer . .

. . . for measuring surface temperatures of rotating objects without actual contact of probe with surface; consists of resistance sensing head and battery operated temperature indicator; probe is held close to surface, conduction losses of surface heat resistance element; for temperatures up to 450 F—*Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.*

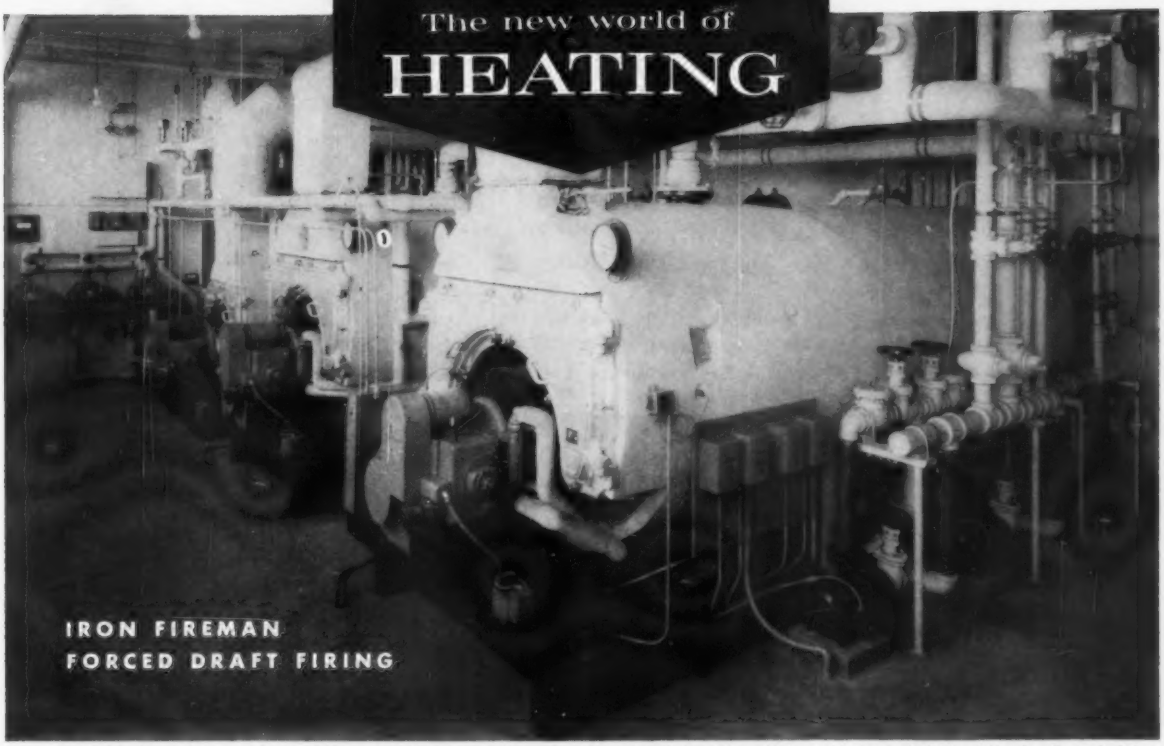
Propane Torches . . .

. . . for heavy duty applications in four different packages, each with different torch head: pencil point, medium size, large size, and dual purpose; kits also contain pistol grip torch handle and spark lighter, all parts are chrome plated—*Turner Corp., 821 Park Ave., Sycamore, Ill.*

Solenoid Valve . . .

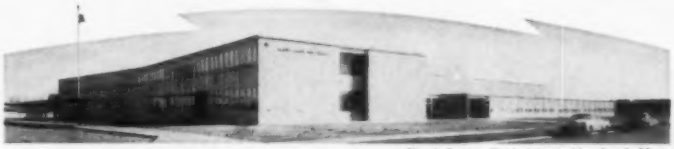
. . . for 3-way directional control of air, oil, inert gases available in 3/32, ⅛, and 5/32 in. orifice sizes, operates on pressure differentials up to 250 psi; with bodies of die cast zinc, stainless steel internal parts, synthetic inserts—*Skinner Electric Valve Division, 105 Edgewood Ave., New Britain, Conn.*

The new world of
HEATING



Architect, Foss and Company, Moorhead, Minn.; Consulting Engineer, Gausman and Moore, Inc., St. Paul, Minn.; Mechanical Contractor, R. Gilb and Sons, Inc., Fargo, N. Dakota.

NO STACK



North Junior High School, Moorhead, Minn.

Requires an exhaust vent only

Iron Fireman forced draft firing eliminates the need for a high stack, such as required for natural draft firing. This not only saves costly construction, but avoids the architectural disfigurement of a beautiful building.

Forced draft firing also has distinct advantages over an induced draft system. The latter operates in the high temperature exit gases at the boiler breeching, where gas volume has been enormously expanded by furnace heat requiring much greater fan capacity. Forced draft mechanism moves air at room temperature, with power savings as high as 50%. The electrical power consumption is reduced in proportion to the *volume, not* the *weight* of the air handled. It is quieter, more compact, more easily accessible and requires less maintenance.

Complete package, ready to go

Every factor that affects firing efficiency is engineered into the unit at the factory. Unit includes: (1) Oil, gas or dual-fuel burner. (2) Forced draft air supply. (3) Enclosed control panel (optional) with instruments mounted, factory wired and tested, and with signal lights and dials for a complete reading at a glance. Firing units are available with complete boiler-burner units, as shown here, requiring only service connections, or as a package burner suitable for any type of boiler.

Fires gas or low-cost residual oils, or both

Fires any type of fuel gas, or any grade of fuel oil from lightest to heaviest without burner adjustment. Available for gas, oil or dual-fuel firing with instant changeover. Simple capacity tables make them easy to size and specify.

Mail coupon for full information and specifications

IRON FIREMAN

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRCRAFT GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

Iron Fireman Mfg. Co., 3098 W. 106th St., Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto)

Please send complete technical description and specifications on Iron Fireman forced draft firing.

Name _____

Firm _____

Address _____

City _____ State or Prov. _____

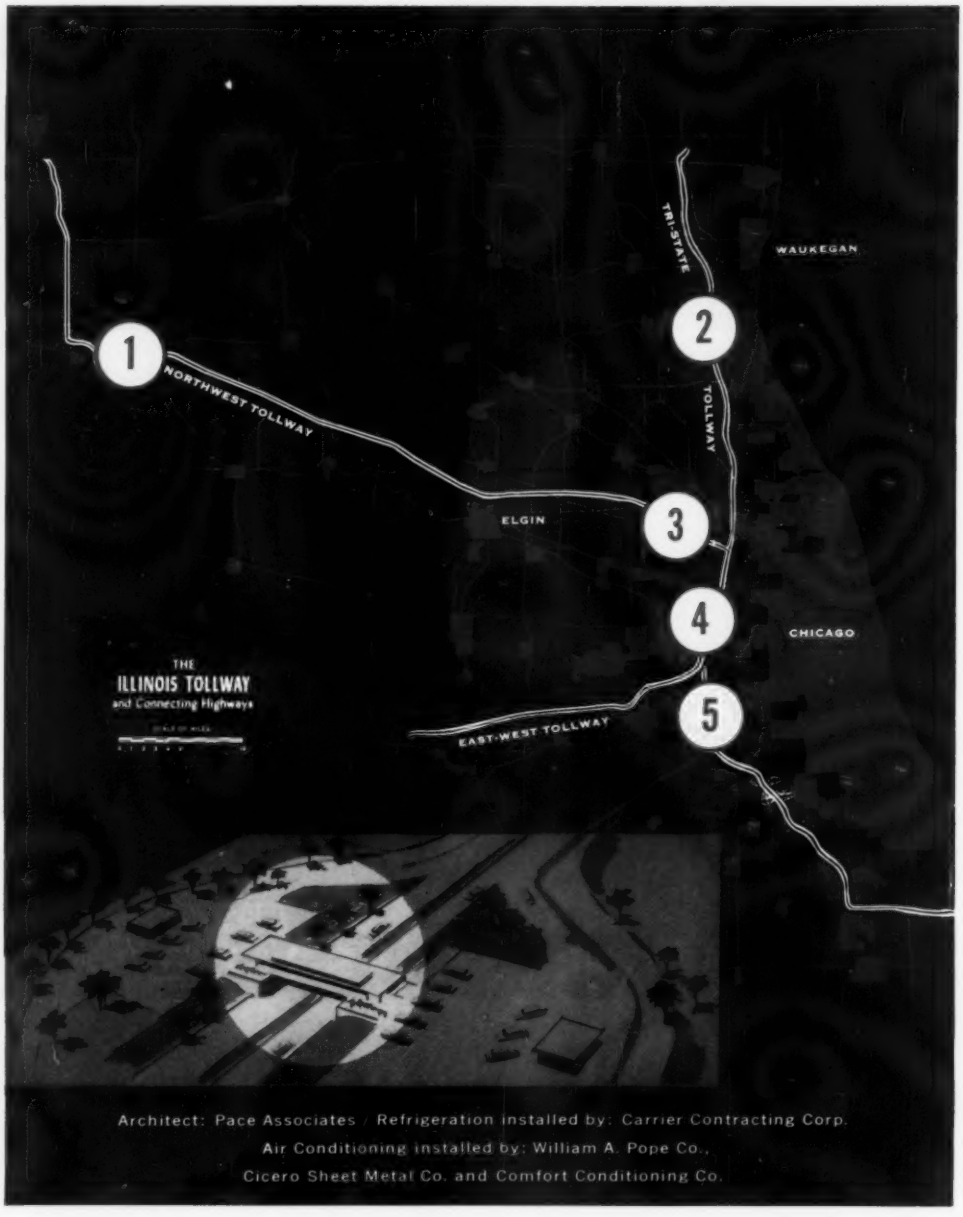
Engineering the temperature...

with RECOLD on the Illinois Tollway

At any of the five "Oases" along the 187-mile Illinois Tollway, motorists may dine and relax at Fred Harvey Restaurants overlooking the highway or service their automobiles at Standard Oil stations. Everywhere, be it toll gate, restaurant or service station, year-round comfort is assured with air-conditioning by Recold Corporation.

RECOLD **CORPORATION**
7250 East Slauson Avenue, Los Angeles 22, California

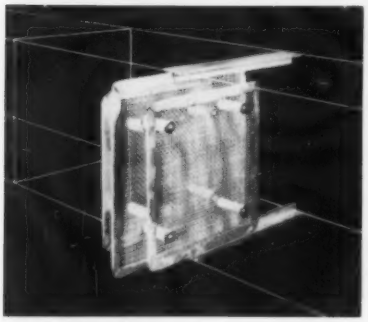
RECOLD



Architect: Pace Associates / Refrigeration installed by: Carrier Contracting Corp.
Air Conditioning installed by: William A. Pope Co.,
Cicero Sheet Metal Co. and Comfort Conditioning Co.

EQUIPMENT DEVELOPMENTS

Continued

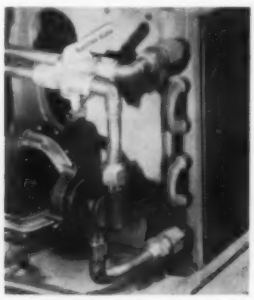


Dust Ionizer . . .

. . .consists of electrically charged screen installed in return duct of air conditioning or heating systems, operates by bombarding dust particles to less than 0.1 micron size; negatively ionized particles remain suspended in air stream, according to manufacturer; designed capacity is 10,000 cfm with system generator —*CRS Industries, Inc., Philadelphia 2, Pa.*

Needle Bearing . . .

. . .thrust type with glass fiber-filled nylon retainer to reduce sliding friction; in any combination of bore and outside diameter sizes, with standardized 0.078 in. diameter needle rollers —*The Kaydon Engineering Corp., McCracken St., Muskegon, Mich.*



By-Pass Valve . . .

. . .for induction and fan-coil air conditioning systems, combines inlet and outlet stop valve and by-pass or flushing valve functions in one casing; 90 degree turn of control handle opens by-pass and shuts off water supply to coil; in sizes to accommodate ½ or ⅝ in. OD copper tubing with soldered or flared connections — *Clayton Mark & Co.*, 1900 *Dempster St., Evanston, Ill.*

Satisfy more "tough clients" with Reznor

NEW AUTOMATIC VENTER

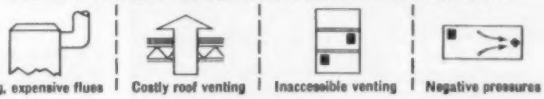
lets you install Reznor unit heaters almost anywhere!

Now, with the Reznor Venter, you can install direct-fired Reznor heaters where you couldn't before—in multi-story buildings or structures with hard-to-get-at chimneys! You'll save money for your "tough clients."

The Venter, available exclusively with Reznor Heaters, is a motorized automatic vent exhauster that mounts directly on the heater. A 4-inch diameter vent pipe is all that is needed to carry burned gases to a sidewall—or down through the floor and out, if you choose. No more costly roof venting or big, expensive flues. Heaters operate more efficiently, too, especially if the room has an exhaust fan which creates a negative pressure.

There's a Venter for all Reznor Heaters up to 300,000 Btuh. Ask your representative for Catalog SA-5900, with data on all Reznor Heaters and the new Venter. Or write Dept. 51-Q, Reznor Manufacturing Co., Mercer, Pa.

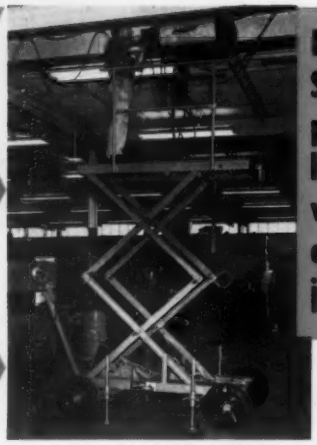
USE THE REZNOR VENTER AND AVOID THESE PROBLEMS:



Big, expensive flues | Costly roof venting | Inaccessible venting | Negative pressures

REZNOR HEATERS

"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"



NEW SKY WITCH puts load and workmen at job height!

Work height easily varied with a touch of the controls

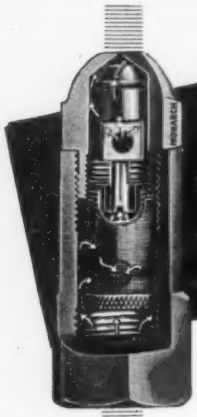
Sky Witch, the new **CHARLES** product, is a...

WORK-LOAD LIFT!

For construction, installation, and overhead maintenance... in industrial plants and commercial buildings... chemical plants, refineries... inside or outside! Sky Witch offers 6 basic models with various power and mounting options. Portable and hydraulic, it lifts the load and serves as an adjustable work platform... heights to 24 feet, loads to 2,000 pounds! Write for details.

CHARLES Machine Works, Inc.

1530 S. STREET • PERRY, OKLAHOMA • FE 6-4404



Monarch NOZZLES For HUMIDIFYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG I

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B. C.)
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EQUIPMENT DEVELOPMENTS

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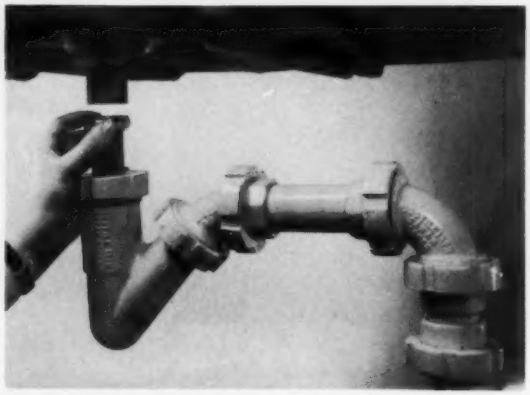
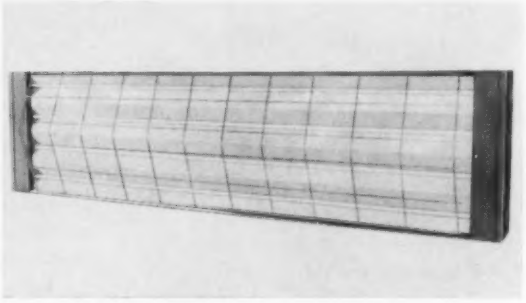


Drain Line System . . .

. . . non-corrosive, for piping of waste acids, alkalies, or solvents to ceramic waste sewers, uses saran lined pipe, ductile iron fittings; fittings are union type with round connector nuts, "O" ring gaskets; system said to resist inorganic chemicals, most organic solvents and compounds, is applicable for below-zero to 200 F temperature ranges; piping manufactured by *The Dow Chemical Co.*, distributed through *Saran Lined Pipe Co., Ferndale, Mich.*

Water Treatment Control . . .

. . . automatically regulates treatment and bleed-off feed in proportion to rate of water evaporation or to cooling load; available in all sizes for application to any cooling tower, according to manufacturer; pan float actuates micro switches to control bleed-off valve, make-up valve and feed pump—*Associated Laboratories, Inc.*, 26845 *Southfield, Lathrup Village, Mich.*



Infrared Heater . . .

. . . electric, with quartz tube elements, 1 ft × 4 ft dimensions; 4 and 6 kw panels are available for 208 and 240 v, or for series operation at 480 v; panels may be mounted horizontally at any angle, grouped, on ½ in. conduit stems; equipped with nickel plated steel grilles, insulated between reflector and panel back; bulletin "PG-104" available upon request — *Edwin L. Wiegand Co.*, 7500 *Thomas Blvd., Pittsburgh 8, Pa.*

when you want it Quiet you want the new McQuay SEASONVENT

heating and ventilating unit

The highly efficient sound-absorbing plenum sections and internally mounted fan motors make the McQuay Seasonvent quiet in operation—the ideal unit for auditoriums, theatres and similar installations. The Seasonvent is super efficient, too, and extremely versatile, with nine sizes for low static applications (0″ to 1¼″) and seven sizes for high static operations (1″ to 2″), with capacities from 1250 to 15,000 cfm.

for horizontal vertical or wall mounting arrangements

When you want quiet operation, you'll surely want the new, quiet Seasonvent. Call your McQuay representative for complete information, or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

McQuay Means Quality

In convention halls, coffee shops and commuter trains...

Heated discussion is still a convention trademark, but physical swelter has given way to air-conditioned comfort in giant convention halls. The amount of air-conditioned space needed for meetings and exhibits often has a bearing on the location chosen for major conventions.

Quick snacks and coffee breaks are bread and butter to the modern air-conditioned "coffee shop"—a relatively new and thriving institution in busy urban centers.

Brow-mopping days are over for many train travellers, thanks to air-conditioning. Air-conditioned cars pay off in increased traffic—and immeasurable good will.

You'll find

genetron®

SUPER-DRY REFRIGERANTS

Approved!
Accepted!
Preferred!

For great and small cooling jobs by the thousands—for original or replacement charge—you'll find "Genetron" Super-Dry Refrigerants approved . . . accepted . . . preferred! Men who manufacture America's finest refrigeration and air-conditioning equipment as well as those who design it, install it and service it, all endorse "Genetron" Super-Dry Refrigerants. Wholesalers recommend them for their consistent high purity, maximum dryness, and over-all top quality.

"Genetron" Super-Dry Refrigerants are stocked from coast to coast by all leading wholesalers. Use the best! Insist on "Genetron" Super-Dry Refrigerants!

genetron 11 ORANGE LABEL CCl_3F
TRICHLOROMONOFLUOROMETHANE

genetron 12 WHITE LABEL CCl_2F_2
DICHLORODIFLUOROMETHANE

genetron 22 GREEN LABEL $CHClF_2$
MONOCHLORODIFLUOROMETHANE

genetron 113 PURPLE LABEL $C_2Cl_3F_3$
TRICHLOROTRIFLUOROETHANE

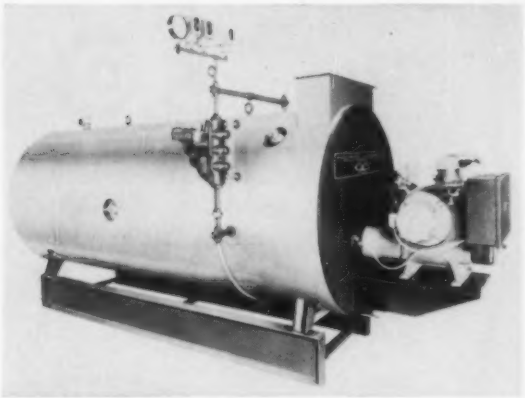
genetron 114a BLUE LABEL $C_2Cl_2F_4$
DICHLOROTETRAFLUOROETHANE

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N. Y.

Allied Chemical

EQUIPMENT DEVELOPMENTS

Continued

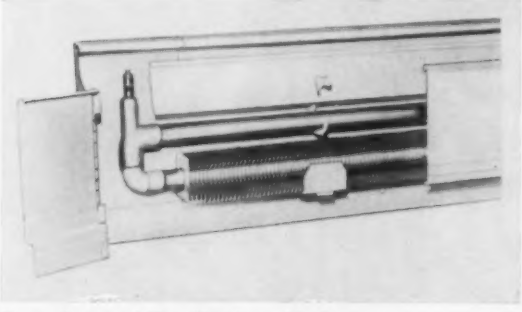


Packaged Boilers . . .

. . . Scotch-type, two pass design, in 21 sizes for light or heavy oil, natural or LP gas at 720,000 to 21 million Btu per hr input; fuel switch can be made without burner modification; units are for low, 125, or 150 lb steam pressures, with capacities from 10 to 460 hp; boiler and burner are mounted on single frame, with integrated wiring, piping, gages and controls—*Industrial Combustion, Inc.*, 4507 *North Oakland Ave., Milwaukee, Wis.*

Air Pressure Regulator . . .

. . . for up to 80 cfm air flow at 100 psi with 200 psi supply pressure, operates in any position, handles bi-directional air flow; unit includes a 160 psi, 1-½ in. diameter gage for back or lower mounting, knurled adjusting knob for pressure regulation without special tools; said to afford accurate pressure regulation with minimum fluctuation—*Jarett Compressor and Equipment, Inc.*, 275 *Central Ave., Newark, N.J.*



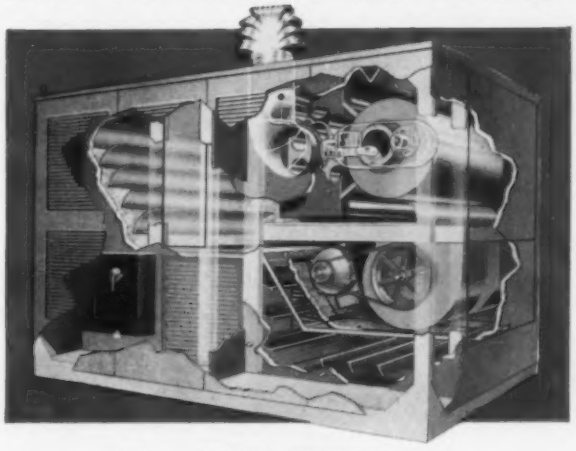
Baseboard Radiation Unit . . .

. . . rated at 600 Btu per linear ft with 180 F water, 1 gpm flow, features "finger tip control" damper, standard snap-on fittings, die-cast brackets designed to grip element and provide nest for tubing as well as allow for expansion and contraction; bulletin "9360" available upon request — *A. Brown Products Corp.*, 1090 *Springfield Rd., Union, N.J.*

MAMMOTH

Compact-Aire

ROOF-TOP HEATING AND COOLING



Oil or gas 185,000 to 500,000 B.T.U. output.
Cooling capacity available: 3 to 20 tons.

For Shopping Centers, Supermarkets, Drive-ins, Commercial Buildings, Offices, Schools and Churches

Everything Goes On The Roof! Saves hundreds of square feet of expensive floor space. Roof space costs nothing. Saves by eliminating complex duct work, piping, and wiring. Simplified and lowered constructions and installation costs produce total savings that could pay for entire system.

Year Round Fresh Air Comfort. Fresh air is picked up at roof-top level, filtered, heated or cooled according to season. High efficiency of Compact-Aire assures 12 month comfort air-conditioning.

For Big Buildings and Small. Extreme simplicity of installation, flexibility of units and low cost of operation makes Compact-Aire Roof-Top Heating & Cooling ideal for buildings of all sizes. Write for information.

MAMMOTH FURNACE COMPANY
6425 Cambridge St., Minneapolis, Minnesota

Gentlemen:

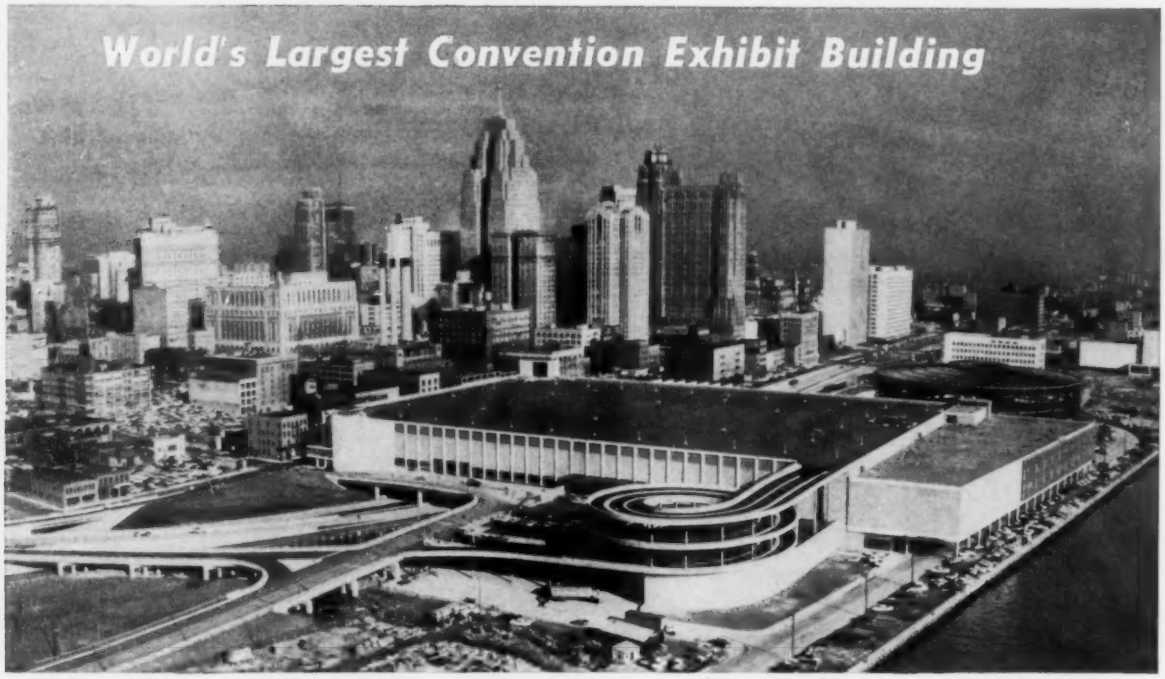
Please send information on Compact-Aire Roof-Top Units, available sizes, costs, etc.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Detroit's Magnificent COBO HALL



Giffels & Rossetti
Architects-Engineers

The O. W. Burke Company
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Stanley Carter Company
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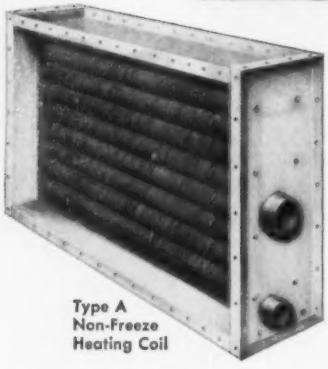
Robert Irsay Company
Sheet Metal-Ventilation

Detroit Free Press
Photo by Tony Spina

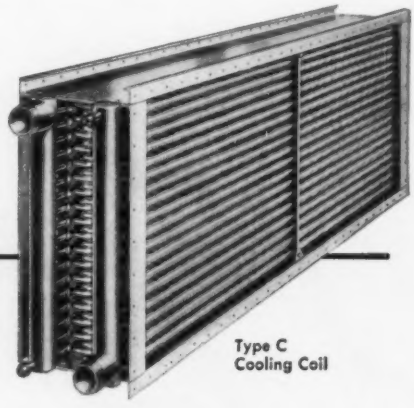
AEROFIN INSTALLED



Type A
Non-Freeze
Heating Coil

Modern smooth-fin design of Aerofin coils permits ample heat-exchange capacity in limited space–permits the use of high air velocities without turbulence or excessive resistance.

Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.



Type C
Cooling Coil

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N.Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ENGINEERING OFFICES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS

Continued

Air Cooled Condenser . . .

. . . featuring low silhouette design, in five sizes, 10 through 30 tons; with vertical discharge blower for location without regard to prevailing winds; motor-compressor, liquid receiver, electrical controls, and accessories are mounted in separate section for attachment to main blower section or remote location; bulletin "7017-1" available upon request—*Dunham-Bush, Inc., 179 South St., Hartford, Conn.*

Combustion Analyzer . . .

. . . measures carbon dioxide content of flue gas, stack temperature and draft, provides direct reading in less than 10 seconds with single meter and dial; available in heavy-duty industrial model—*Victory Engineering Corp., 612 Springfield Rd., Union, N.J.*

Expansion Joint . . .

. . . for copper water tube applications on low pressure steam and hot water systems compensates for expansion and contraction of 100 lineal ft of tube; incorporates synthetic "O" rings on brass piston, with fiber guide bearing bushing; designed for 40 to 240 F temperature range at up to 150 psi, available in ½ through 2 in. sizes—*Chase Brass & Copper Co., 236 Grand St., Waterbury 20, Conn.*

HOW TO SAVE 80% PIPE HANGING TIME!

★ Fits all ½" to 8" metal or plastic pipe

★ Listed by Underwriters' Laboratories, Inc., Approved by Factory Mutual Laboratory

"AUTO-GRIP" JOB-DESIGNED BY INDUSTRIAL ENGINEERS FOR TOP UTILITY... MINIMUM PARTS... NO WASTE MOTION!

★ Self-locking, compact, attractive

★ Safe load exceeds rating for standard types—safety factor 5:1

"AUTO-GRIP" was designed by "Automatic" Sprinkler Corporation industrial engineers for their own use as piping installation contractors. "AUTO-GRIP" ease, simplicity, speed and economy soon established it in the trade as the top improvement in pipe hanging efficiency in 50 years!

LOWER INITIAL COST—competitive with least expensive outmoded, cumbersome rings, bands and clevises.

SMALLER INVENTORY—universal adaptability permits quantity buying of fewer types—less storage space.

SAFER—MORE ATTRACTIVE—self-locking via spring tension and pipe weight . . . shipped assembled, stays assembled . . . zinc-coated or copper-plated.

REDUCES LABOR COSTS—tests by industrial engineers reveal that "AUTO-GRIP" installs in only 20% of the time required for old-fashioned clevis-type rings. Universal, counterbored hanger insert secures quickly to ceiling hanger rod. Insert is adjusted easily on rod by finger strength.

HOW "AUTO-GRIP" WORKS

Squeeze together —insert drops out

Spread and slip over pipe

Squeeze— replace insert

FREE SAMPLE • TIME-SAVING DATA • MAIL COUPON TODAY!

NAME_____ POSITION_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

#160

AUTO GRIP "Auto-Grip" Division

Box 360 • Youngstown 1, Ohio

"Automatic" Sprinkler CORPORATION OF AMERICA

NEED ONE PUMP?...OR A DOZEN?
...there's a WEINMAN to fit your exact requirements!

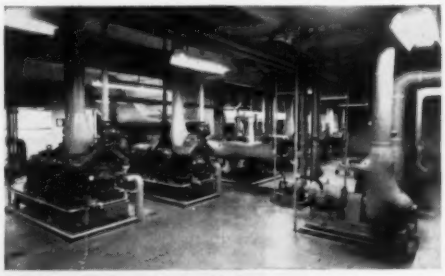
Typical UNIPUMP, available with threaded connection or flange; capacities to 2000 GPM; heads to 260 ft.

For the solution to any pumping problem you can depend on Weinman pump specialists. You can depend on every Weinman installation, too, for the efficient, low-cost operation you want.

Weinman's complete line of dependable, general service Unipumps, with capacities to 2000 GPM, are built to handle man-sized pumping jobs in a minimum of space. Ideal for air conditioning installations, Unipumps operate efficiently from any position for continuous, maintenance-free service.

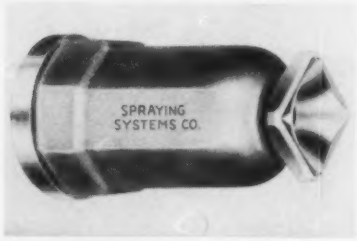
For multiple pump installations Weinman experts work closely with heating and plumbing engineers to meet precise job specifications. An outstanding example is the 12-pump Weinman installation (illustrated below) at the ultra-modern headquarters for Columbus and Southern Ohio Electric Company, Columbus, Ohio. An integral part of one of the world's largest electric air source heat pump installations, built by York Division, Borg-Warner Corporation, Weinman pumps provide vital control of the flow of hot and chilled water through the heating and air conditioning systems of this nine story building. The reason is simple — as specialists in the design and development of centrifugal pumps — Weinman builds to precise requirements.

You'll find your local Weinman Pump Specialist listed in the Yellow Pages. Or, if you want further information, write to us.



THE WEINMAN PUMP MFG. CO.
290 SPRUCE STREET COLUMBUS 15, OHIO
CENTRIFUGAL SPECIALISTS

EQUIPMENT DEVELOPMENTS
Continued

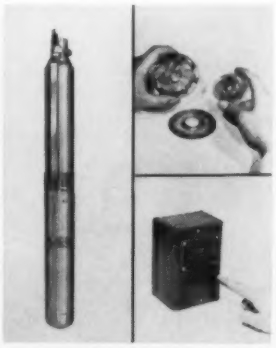


Spray Nozzle . . .

. . .for wide angle, square pattern projection, designed for installation on spray manifolds where open area is dimensionally limited; supplied in 5.9 to 48 gpm capacities at 30 psi, with male or female pipe connections —*Spraying Systems Co., 3219 Randolph St., Bellwood, Ill.*

Welding Wires . . .

. . .of stainless steel for use with submerged arc process on 308, 309, 310, 347, and 502 stainless; chemical composition said to conform to AWS and ASTM standards for corrosion resisting and chromium nickel steels; available in 25 and 50 lb coils—*Air Reduction Sales Co., 150 E. 42nd St., New York 17, N.Y.*



Submersible Pumps . . .

. . . in eight models, 1/3 and ½ hp sizes with 115 or 230 v motors, high capacity or high pressure types; fit 4 in. minimum diameter wells, constructed of synthetic material for heat, abrasion, water absorption resistance with stainless steel shafts and diffuser guide inserts; all control elements incorporated in single control box—*F. E. Myers & Bro. Co., Ashland, O.*

Keflex Manufacturing Division
U. S. Flexible Metallic Tubing Co.
Since 1905

KEFLEX

LAMINATED STAINLESS STEEL BELLOWS
See Our Catalog in Sweet's Files

General Offices — 63 Main St., San Francisco 5, Calif.
Factories — Los Angeles — San Francisco
Sales Offices — Agents in Principal Cities of U. S. and Canada

KEFLEX QUADRA-SIDE EXPANSION COMPENSATORS
FOR STEAM AND HOT WATER HEATING SYSTEMS
USED WITH CONVECTOR AND FIN TUBE BASEBOARD RADIATION UNITS
IN SCHOOLS, HOSPITALS, OFFICES AND COMMERCIAL INSTALLATIONS

TYPE 7 Q square brass telescoping case protects laminated stainless steel bellows from torsion, squirm, misalignment and external damage. Compensators are used in high and low pressure hot water supply lines, risers and for baseboard radiation. Extra flexibility provides maximum cyclic life. Units are very compact and rugged. Sizes ¾" thru 3". Pressures to 300 PSI. Temperatures to 800°F. Traverse: Single Units, total 2" (1-½" compression, ½" extension) Dual units available.

TYPE 11 Q-T has heavy square telescoping case and laminated stainless steel bellows. For use in risers and with baseboard radiation. Test pressure 150 PSI, working pressure 100 PSI, temperatures to 300°F. Traverse: Total 1" (¾" compression, ¼" extension).

TYPE 7 Q WITH BRASS FEMALE THREADED ENDS
Working Pres. 300 PSI Maximum Temp. 800 F

Pat. Pend.

Nom. I.P.S.	Overall Length	Max. O.D.	Wt. #
¾"-1.00"-1.25"	6.50"	2.00"	2
1.50	6.50	2.50	4
2.00	6.50	3.00	5
2.50	6.50	3.50	6
3.00	6.50	4.00	9

TYPE 7 Q-T WITH COPPER TUBE ENDS
Maximum Pres. 200 PSI Maximum Temp. 300 F

Pat. Pend.

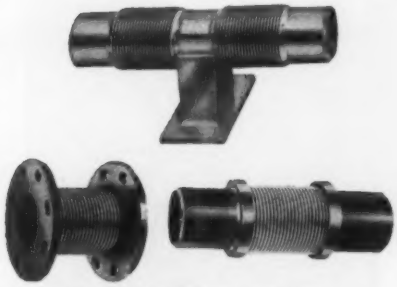
To Fit Copper Tubing		Overall Length	Max. O.D.	Wt. #
Nominal I.D.	Actual O.D.			
¾"	⅞"	6.50"	2.00"	1½
1	1⅛	6.50	2.00	1½
1¼	1⅜	6.50	2.00	1½
1½	1⅝	9.00	2.50	3½
2	2⅛	10.00	3.00	4½
2½	2⅝	10.75	3.50	5½
3	3⅛	11.50	4.00	8¼

TYPE 11 Q-T WITH COPPER TUBE ENDS
Maximum Pres. 100 PSI Maximum Temp. 300 F

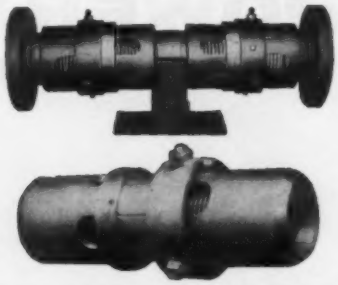
Pat. Pend.

To Fit Copper Tubing		Overall Length	Max. O.D.	Wt. #
Normal I.D.	Actual O.D.			
¼"	⅞"	4.50"	1.50"	1¼
1	1⅛	4.50	1.50	1¼
1¼	1⅜	4.50	1.75	1½
1½	1⅝	4.50	2.25	3
2	2⅛	4.50	2.75	4

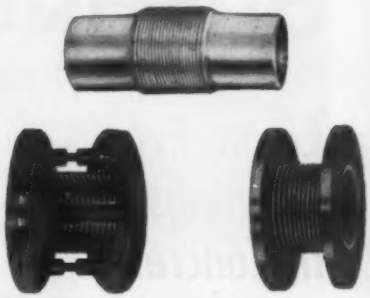
EXPANSION JOINTS—VIBRATION ABSORBERS—FLEXIBLE CONNECTORS—PIPE GUIDES
Force Required to Compress Keflex Expansion Joints Their Full Rated Traverse is Usually Less Than 100 Lbs., Total



KEFLEX EXPANSION JOINTS — corrugated, packless type for steam and hot water heating systems and process piping. Laminated stainless steel bellows with internal liner guides and stainless steel contour control rings. Weld ends, or flanges. Outside shrouds and intermediate anchor bases available. Sizes 2" through 48". Pressures 70 to 450 PSI. Temperatures to 800° F. Furnished for various required traverses.

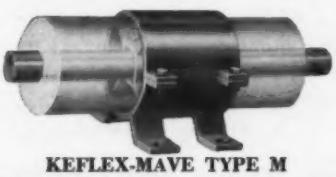


KEFLEX-KETROL CONTROLLED EXPANSION JOINTS — positive protection against torsion. For use in pipe lines to compensate for expansion and contraction. Shroud has intermeshing fingers providing concentric guiding and protection against squirm, torsion, and external damage to laminated stainless steel bellows. Designed for high pressure, high temperature hot water service. Movement is controlled by limit stops. Sizes 2" through 48". Pressures to 450 PSI and temperatures to 800° F.



KEFLEX FLEXIBLE CONNECTORS AND VIBRATION ABSORBERS — to absorb vibration from pumps, chillers, and compressors. Serves to relieve stress on pump volute when piping is misaligned. Extra flexibility of laminated stainless steel construction produces long cyclic life. Compact units save space and are easy to install. Available with or without tie rods. Sizes 2" through 48". Pressures to 450 PSI and temperatures to 800° F.

Modified Types are available for special conditions requiring higher pressure, temperatures, traverse, or combination deflections.



KEFLEX-MAVE TYPE M

Fabricated steel pipe guides for concentric guiding of pipe lines. Special insulated guides are available for chilled water.

FLEXIBLE "BMH" CONNECTORS

"USF" BRONZE VIBRATION ABSORBERS

Braided bronze Metal Hose assemblies made in standard lengths. Usually used as flexible connectors on pumps and other mechanical equipment for heating and air conditioning service. Available with threaded male ends, flanges, and copper tube sweat ends.

800 to 1 hp favorites for quiet operation, low maintenance and long-life service . . .

From the case of the A. O. Smith Motor Man — a complete stable of integrals that include single-phase models (1-5 hp) or polyphase (1-800 hp). Also a team of fractional-hp motors. All are sure bets to give top performance over the long, long haul.

And there's an A. O. Smith Motor Man near you — chomping at the bit to give you 24-hour action on all parts and service orders.

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Through research ...a better way

A.O.Smith CORPORATION
ELECTRIC MOTORS
Tipp City, Ohio
A. O. SMITH INTERNATIONAL, S.A.
Milwaukee 1, Wisconsin, U.S.A.

CUTTING POWER!

Clean, Even Openings in Concrete and Cast Iron

To make large square openings through a 13-inch reinforced concrete floor, a construction firm decided on a Longyear diamond drill. *All 60 holes were made with one 4-inch Longyear bit, and drilled in 6-10 minutes each.* Another contractor drilled *fifty* 2-inch holes *in cast iron pipe* with Longyear equipment and a single Longyear diamond bit. Actual drilling took only 1-2 minutes to make a clean, even hole in the 6-inch pipe. Call your Longyear dealer for more information on Longyear electric and air powered drills and bits.

Adv-170

Longyear

E. J. LONGYEAR CO.
76 S. Eighth Street
Minneapolis 2, Minnesota
Phone: FEderal 9-7631

Please send complete information on Longyear Diamond Bits and Industrial Drills. Also the name of my nearest Longyear dealer.

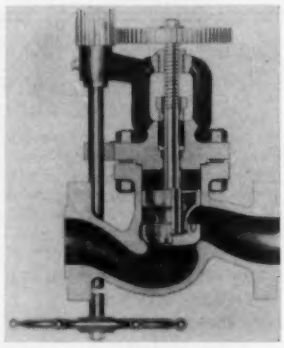
NAME_____

FIRM_____

ADDRESS_____

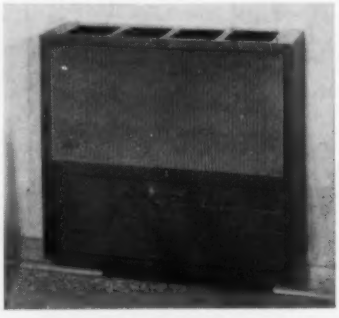
TOWN_____ STATE_____

EQUIPMENT DEVELOPMENTS
Continued



Cast Steel Valves . . .

. . . globe and angle-stop, gate, and non-return stop-check, rated at 600 psi at 850 F, feature stellite seats, internal contours designed to minimize pressure losses, "Impactor" handwheels which permit one-man seating of disk in close quarters without large handwheels; in sizes from 2 ½ to 12 in., with bolted bonnets on up to 6 in. sizes, pressure seal bonnets on larger sizes, flanged and welding ends—*Edward Valves, Inc.*, 1200 *W. 145th St., East Chicago, Ind.*



Gas-Fired Heater . . .

. . . for through-the-wall installations, in two models, 22,000 and 30,000 Btu input with natural or LP gas; units are 30 in. wide by 9 in. deep, fasten 4-¾ in. above floor for total height of 30-¾ in.; burner is vented through the wall, uses outdoor air only for combustion and discharges directly to outside; combustion chamber is sealed, has safety shutoff; available with manual or automatic controls, two-speed blower; remote control kit and vent extension are optional—*The Coleman Co., Inc.*, 250 *N. St. Francis St., Wichita* 1, *Kans.*

USE THESE FLEXIBLE "PACKAGES" FOR DEPENDABLE ECONOMICAL HEATING!

Roberts-Gordon

GAS-FIRED

UNIT HEATERS

- EASILY INSTALLED—Ready to connect, vent and operate.
- COMPACT—Ideal for space-saving installations.
- MINIMUM MAINTENANCE—Result of high quality construction.

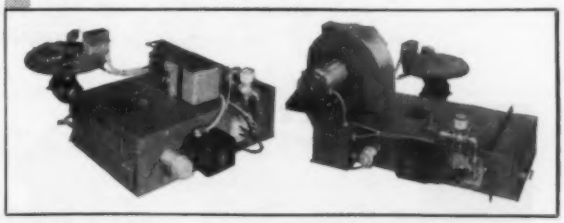
Roberts-Gordon Unit Heaters are quality built throughout, insuring maximum performance and dependability. Heat exchanger with all-welded corrosion-resistant aluminized steel tubes provides long, trouble-free life. Scientific high heat transfer design means maximum efficiency and economy. Both propeller fan and blower type models available. Effective louver design diffuses heat evenly. 25,000 to 250,000 BTU/Hr. input.

Investigate the many advantages of Roberts-Gordon Unit Heaters. Write for free literature and the name of nearest factory representative. Sales and service coast-to-coast in U.S. and Canada.

ROBERTS GORDON BY DANA

CUSTOM ENGINEERING SERVICE

Roberts-Gordon offers the finest Custom Engineering Service to meet your needs. Call on us — no problem is too big or too specialized.

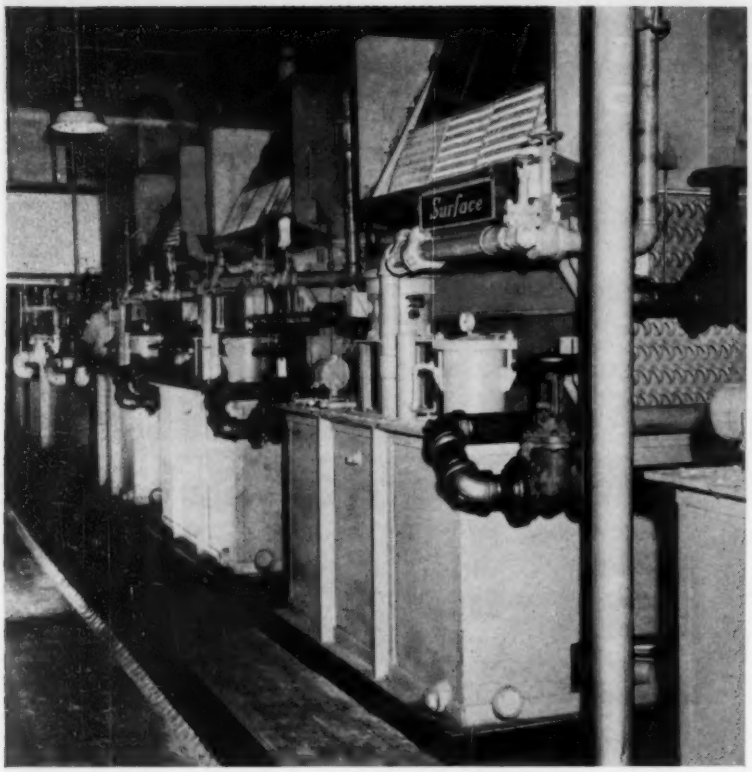


Roberts-Gordon Multuri
Atmospheric Gas Burners. Capacities: 700,000 - 9,450,000 BTU/Hr. Extremely quiet operation.

Roberts-Gordon Power Multuri
Gas Burner. Capacities: 700,000 - 19,600,000 BTU/Hr. Ideal for larger installations.

ROBERTS-GORDON APPLIANCE CORP.

44 CENTRAL AVE. • DEPT. HP • BUFFALO 6, N. Y. • IN CANADA—GRIMSBY, ONT.



120 GRAINS CUT TO 45 IN 200,000 cfm OF AIR WITH 85° TOWER WATER

Without Kathabar, this job would have taken 1800 tons of refrigeration, at about 35F and reheating air from about 45F to 98F! With Kathabar the job took 6 hp instead of 2000. Ask the men who have seen Kathabar Type C units serve for years with practically no maintenance. Write for specific information.

Surface

SURFACE COMBUSTION

Division of Midland-Ross Corporation MR

2384 Dorr St., Toledo 1, Ohio

Send facts on Kathabar systems for the following application:

name and title.....

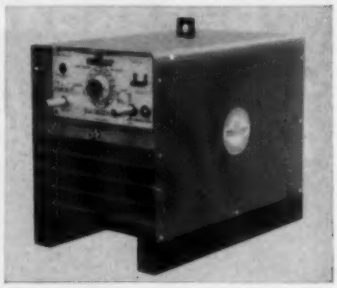
company.....

street.....

city.....*zone*.....*state*.....

EQUIPMENT DEVELOPMENTS

Continued



D-C Welder . . .

. . . designed for indoor use, offers economy with no sacrifice of performance due to absence of some weatherproofing, according to manufacturer; unit features horizontal design for space saving, sealed semi-metallic rectifier, "lifetime" cooling system, electric control; in two models, each with dual current ranges: 40 to 295 and 75 to 450 amps; 50 to 350 and 100 to 600 amps—*Miller Electric Mfg. Co., Inc., 718 S. Bounds St., Appleton, Wis.*

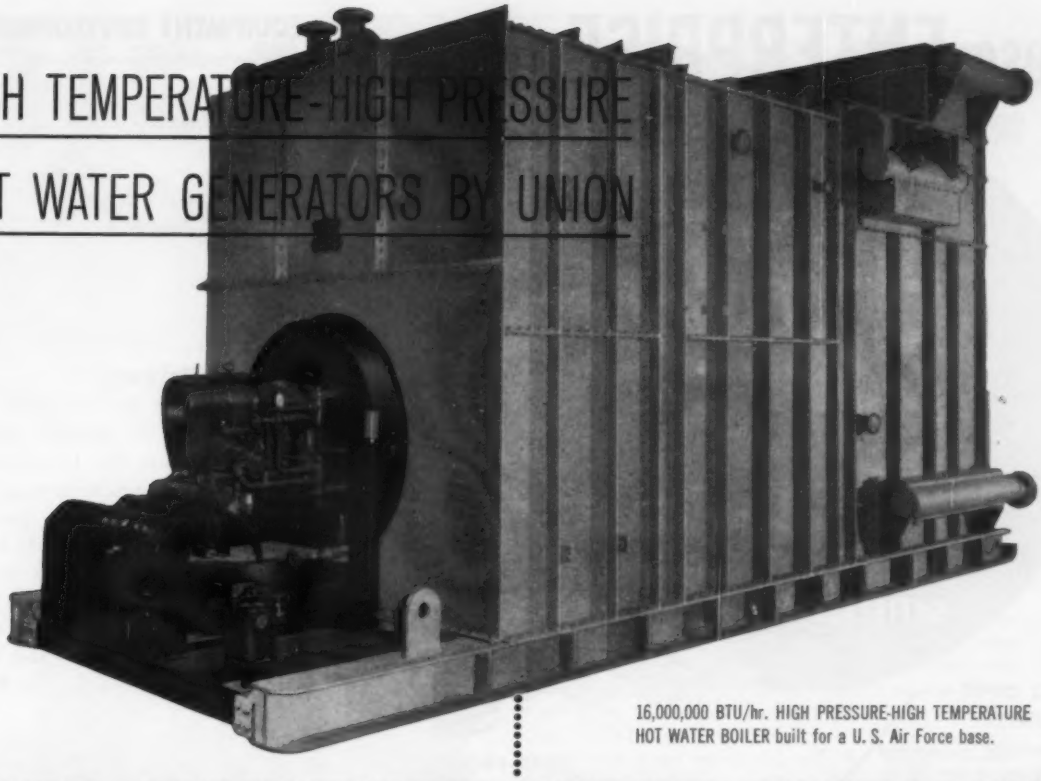
Portable Drill . . .

. . . featuring keyless chuck said to afford extreme holding accuracy, in ¼ in. size, drill jaws are hand locked and self-tightening—*Porter-Cable Machine Co., Seneca St., Syracuse, N. Y.*

Foot Check Valve . . .

. . . features acetal resin disc retainer guide which replaces stem and stem guide for elimination of corrosion and mineral buildup; manufacturer states valve is adaptible in severe water, oil, and gas conditions up to 180 F; feature is also incorporated in series of line check valves—*White Flomatic Division, Flomatic Corp., Hoosick Falls, N.Y.*

HIGH TEMPERATURE-HIGH PRESSURE HOT WATER GENERATORS BY UNION



16,000,000 BTU/hr. HIGH PRESSURE-HIGH TEMPERATURE HOT WATER BOILER built for a U. S. Air Force base.

SHOP ASSEMBLED UNITS INSTALLED WITHOUT COSTLY FIELD BALANCING

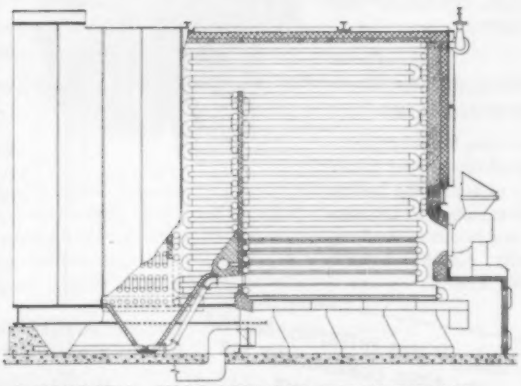
Right from the start, you can save with a Union shop assembled HTHP Hot Water Generator. With all of its circuits of the same hydraulic length, time consuming field balancing can be eliminated. Most units do not require orifices or any other mechanical adjustments to equalize flow at the time of installation.

High water velocities (above 5 ft./sec.) and liberally proportioned, water cooled furnaces eliminate localized overheating. As there are no multi-tube circuits in the radiant section, recirculation within a circuit is impossible, thereby eliminating vapor binding or stagnant flow areas.

Liquid and gas flow run counter to each other. With the liquid inlet positioned at the top of the convection section, the lowest temperature liquid is served by the lowest temperature gas. As a result, generator efficiency is improved and the risk of thermal shock minimized.

Standard units (both shop assembled and field erected) can be modified to meet a wide range of job requirements. They can be arranged for firing with most commercial fuels as well as waste fuels in liquid, gaseous or solid form.

For specific information, outline your requirements to a Union representative or contact Union Iron Works.



31,000,000 BTU/hr. FORCED CIRCULATION, HIGH PRESSURE-HIGH TEMPERATURE HOT WATER BOILER. Equipped for firing by an oscillating grate spreader stoker with fly ash reinjection. Fully factory-assembled for shipment.

UNION

UNION IRON WORKS • ERIE, PENNSYLVANIA

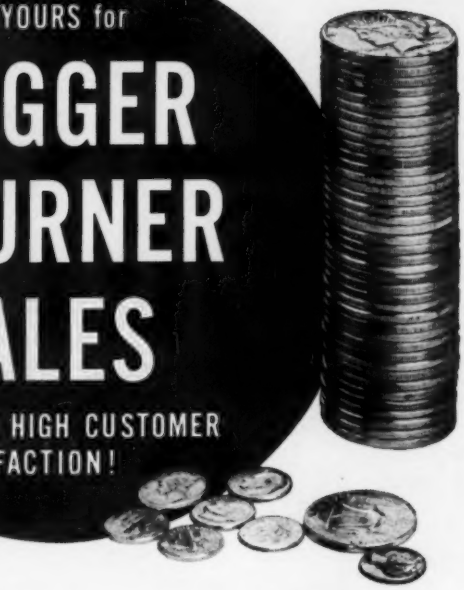
water tube steam generators and allied equipment

these ENTERPRISE features

—are YOURS for

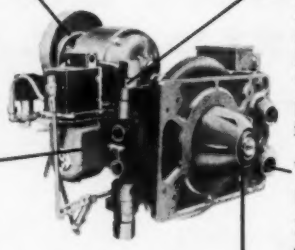
BIGGER BURNER SALES

—AND HIGH CUSTOMER SATISFACTION!



V-BELT DRIVE—EXCLUSIVELY

ENTERPRISE pioneered V-Belt drive for Horizontal Rotary Oil Burners. For 15 years they have been used *exclusively*, for greater efficiency, flexibility and economy!



"MEASURED-RATE" METERING PUMP

Provides for *exact* delivery of the *proper* quantity of oil to the burner—regardless of changes in temperature and viscosity. Another ENTERPRISE first!

LEAK-PROOF HINGE DESIGN

New burner hinge does away with troublesome, leaky packing glands. "O" rings provide for positive, long-life sealing at this critical point!

VENTURI-TYPE IGNITER

Preferred for automatic starting, the ENTERPRISE igniter produces a clean, torch-like flame that eliminates carbonizing, provides failure-proof ignition.

"ANGLE-VANE" AIR NOZZLE

Provides full flame pattern control and efficiency regardless of firebox size and shape!

QUALITY PLUS ENTERPRISE SERVICE —THE RIGHT COMBINATION FOR CONTINUED SUCCESS

ENTERPRISE delivers the "plus" factors that ring up sales, profits and satisfied customers—the key to continued success for ENTERPRISE distributors and dealers. Now is the time to find out about ENTERPRISE—the profit line in commercial and industrial burners. Write today for information.

ENTERPRISE ENGINE & MACHINERY CO.

The Choice of Heating Experts

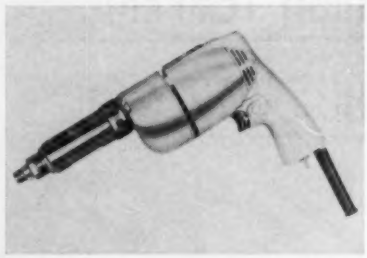
ENTERPRISE

DEPENDABLE BURNERS

Adel Division, General Metals Corporation • 1444 Washington Ave., Huntington 1, W. Va.

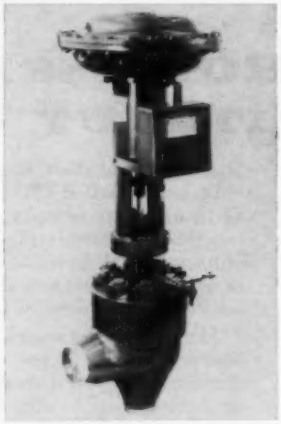
EQUIPMENT DEVELOPMENTS

Continued



Electric Drivers . . .

. . . in assembly and reversing models, handle ¼ in. diameter machine screws and nuts, No. 12 self-tapping screws, feature anti-ratcheting clutch which works at preset point of torque, trigger switch with lock-on device, die cast aluminum housing, cord protector; operate on 115 v or 220 and other voltages on special models, a-c/d-c power—*Skil Corp.*, 5033 *Elston Ave., Chicago* 30, *Ill.*



Throttling Valve . . .

. . . for high pressure liquid and steam is diaphragm operated and available in 1500, 2500, and 4500 lb classes, 1½ through 4 in. sizes; lower pressure classes feature "quick-change" of plug, guide, and seat; series is designed for flow control where high pressure drops or flashing occurs; erosion and cavitation is said to be limited to trim components by extended diffuser section on seat, trim available for linear, equal-percentage, straight-taper, or shut-off response; with variety of bonnet, ends, packing options—*Republic Flow Meters Co.*, 2240 *Diversey Pkwy., Chicago* 47, *Ill.*

HEAT and COOL from ABOVE

—WITH OVERALL SIMPLICITY

(Highest Acoustical Efficiency, Too!)

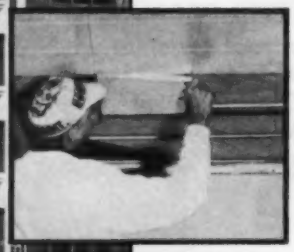
Oklahoma Gas & Electric Company Office Building, Oklahoma City

The superior advantages of the radiant principle as a means of creating comfortable office environments are best demonstrated in the six floor superimposed addition to the general office building of the Oklahoma Gas & Electric Company at Oklahoma City. Over 8,550 square feet of space on the upper six floors have been equipped with the Burgess-Manning Radiant Acoustical Ceiling. The lower six floors are still heated by a conventional heating system.

The use of radiant heating and cooling, combined with definite noise control, offers not only employee comfort, but increased efficiency and overall operating economy.

With radiant energy to heat offices, room temperatures are more uniform, with no drafts. More building space is utilized than with conventional heating systems —no radiators, convectors, registers, etc. occupy usable space.

The Burgess-Manning Radiant Acoustical Ceiling provides heating and cooling with a minimum input of energy or fuel consumption. With fewer mechanized parts, maintenance of the ceiling is greatly reduced. There is definite proof that no other heating system offers so many distinct advantages in comfort, in efficiency, in economy.



Write for the descriptive Burgess-Manning Catalog No. 138-2 . . . and the complete story of Burgess-Manning Radiant Acoustical Ceiling for office building use. No obligation.

3 Heating Cooling Acoustical

BURGESS-MANNING COMPANY

Architectural Products Division

713 East Park Avenue, Libertyville, Ill.

THE BURGESS-MANNING 3-WAY FUNCTIONAL CEILING

67 Problems Solved by Van-Cor PVC Pipe & Fabrications

✓ CHECK THIS LIST

PIPE

Piping Sulphuric Acid
Piping Hydrochloric Acid
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Piping Battery Acid
Piping Vinegar
Piping Brine
Piping Natural Gas
Piping Ammonium Nitrate
Piping Gasoline
Piping Fluoridation materials water system
Piping Sodium Hypochloride (Bleach)
Piping Pulp Stock Lines
Piping Uranium ore slurry
Piping Sand slurry
Piping Coal slurry
Piping Waste Lab Drains
Piping Cyanide
Piping Plating Solutions
Piping Mercury (tube filling)
Piping Pickles
Piping Polysulfide
Piping Wine
Piping Gin
Piping Whiskey
Piping Sea water
Piping Chicken feed
Piping Demineralized H_2O
Piping Warm glue
Piping Salt water
Piping Crude oil
Piping Drinking water
Piping Irrigation water
Piping Chilled water
Piping Sewage
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Fishing Boat Outriggers
Stair Handrails
Vent Stacks
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FABRICATIONS

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Chicken Feed Troughs
Gutters
Plating Racks
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Noise Dampeners
Sinks
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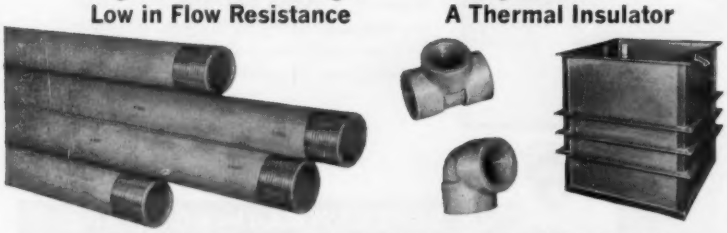
Etching Trays
Pump Bodies
Etching Machinery
Tumbling Barrel Liners
Plating Drums
Loading Chute Liners
Laboratory Fume Duct
Laboratory Fume Hood
Tanks & Tank Liners

VAN-COR SOLVED THESE PROBLEMS BECAUSE IT IS:

Chemical Resistant
Light Weight
High in Tensile Strength
Low in Flow Resistance
Impact Resistant
Dielectric
Easily Installed
A Thermal Insulator



WRITE FOR INFORMATION AND NAME OF NEAREST DISTRIBUTOR

INDUSTRIAL DIVISION OF...

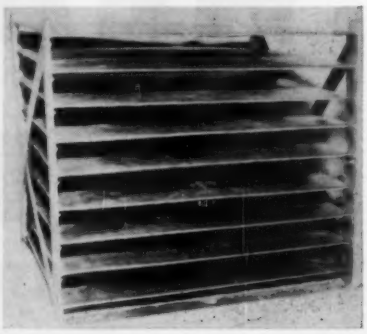
COLONIAL PLASTICS MFG. CO.

Subsidiary of THE VAN DORN IRON WORKS CO.

2685 EAST 79TH STREET CLEVELAND 4, OHIO

EQUIPMENT DEVELOPMENTS

Continued

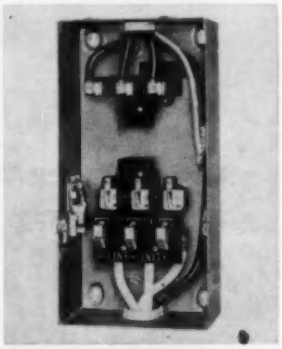


Duct Heater . . .

. . . electric plate bank type, in varying heights, widths, lengths, with 3/16 in. plates spaced according to heating requirements; for single or 3-phase, 208, 220, or 440 v; 3510 sq in. of heat exchange surface per 10 kilowatts capacity can be provided in 2535 cu in., according to manufacturer—*Electric Heater Specialty Co., 21 E. 8th St., New York 3, N. Y.*

Masonry Drill . . .

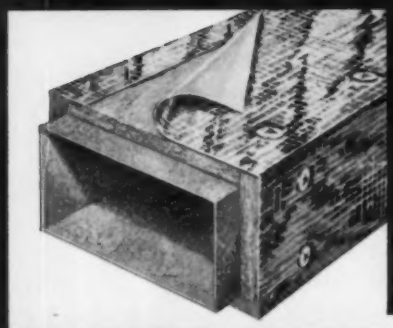
. . . core type, diamond bit using induction motor connected through gears to the spindle; drill head can be rotated through 360 degrees; unit has overload protector, load indicator; in 3 models for holes from ½ to 14 in. diameter—*Clipper Mfg. Co., 2800 Warwick, Kansas City, Mo.*

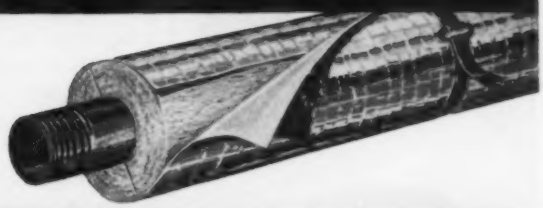


Safety Switches . . .

. . . rated at 100 amps can be installed with line lugs at top or bottom eliminating need to loop wires the full length of the enclosure; uses reversible switch mechanism and on-off nameplate; bulletin "CPD-74" available—*General Electric Co., Distribution Unit, Plainville, Conn.*

PYRO-KURE*





An improved line of flame resistant vapor barriers for insulation facing, duct lining, pipe jacketing

Offers these superior properties:

- *Permanently non-combustible*
- *UL flamespread rating — under 30*
- *Perm rating less than 0.1*
- *Stronger for no-tear application*
- *Better textures for best appearance*

Pyro-Kure vapor barriers will up-grade the insulation with which they are combined. A unique manufacturing development provides *permanent* flame resistance. The adhesive used for laminating the multiple plys of kraft, foil or plastic film and the reinforcing fibers emits a gas at combustion temperature. This gas will snuff out the flame when the ignition source is removed. These products, then, are self-extinguishing.

Pyro-Kure vapor barriers are available in various combinations and standard widths. All of them provide excellent protection against condensation and at a cost equal or below similar vapor barrier material which is still not permanently flame resistant.

Leading insulation manufacturers are now combining Pyro-Kure with their products. For your guarantee of the best, specify "Pyro-Kure."

Write Dept. HP1 for more facts on this new vapor barrier line.

*Patent Applied for.

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Chicago 6 • New York 17 • San Francisco 5
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reinforced paper, foil and plastics for construction, industrial packaging and agriculture

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Enhance the Beauty of Building Skylines

Pats. Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- QUALITY • BEAUTY
- PROVEN PERFORMANCE

Write for bulletin Ha-100 60

AMMERMAN CO., INC.

P.O. Box 182
Stillwater, Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

EQUIPMENT DEVELOPMENTS
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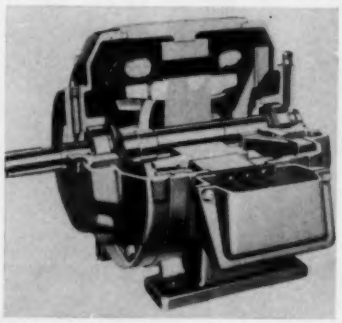


Electric Motors . . .

. . . of open weatherproof design with epoxy encapsulated insulation system, in frames 180 through 445U, 1 through 125 hp; stator windings, bearings, mechanical parts and exposed internal metal surfaces are protected with epoxy resin coating; frame is cast iron, with diagonally split conduit box—*Reliance Electric and Engineering Co.*, 24701 *Euclid Ave., Cleveland* 17, *O.*

Pressure Control . . .

. . . with stainless steel Bourdon tube element and bottom pressure connection, nickel plated internal mechanism, has outside adjustments for setting operating points, visible dial; hermetically sealed mercury contact, also visible, shows whether current is on or off; available operating ranges: 30 in. vacuum to 75 psi; 10 to 100 psi; 30 to 400 psi; 75 to 800 psi; 100 to 1000 psi; available in general purpose, weatherproof, or explosion-proof cases; bulletin "O-19" available upon request—*The Mercoid Corp.*, 4201 *Belmont Ave., Chicago* 41, *Ill.*

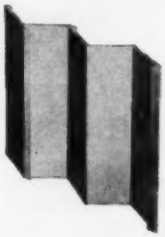
REDUCE COSTS!

SPECIFY

SOPLASCO
PLASTIC
Moisture
ELIMINATOR
BLADES

FOR INDUSTRIAL AIR CONDITIONING

Demand the best! Costs no more. Maintenance costs are negligible as the superior surface of SOPLASCO blades reduce to a minimum the accumulation of algae and lint. Cleaning is accomplished without blade removal.



Southern Plastics Co.

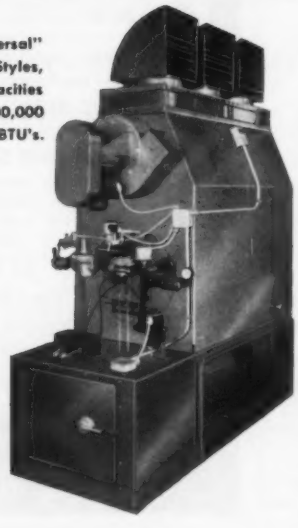
408 Pendleton St.
Columbia, S. C.

For further information write, wire, or phone SOPLASCO AIR PRODUCTS DEPT.

BE CONFIDENT

for space heating **CALL NATIONAL**

National "Universal" Series ITD, 6 Styles, 96 Sizes—Capacities 400,000 to 4,000,000 BTU's.



What makes National Champions best for you?

For one thing, only National gives you a choice between "Total Design" heaters with custom-built burners or conventional packaged heaters. "Total Design" means just that—every component is designed and built by National for a *specific* heater. To you, this means higher efficiency, greater economy, less maintenance and just *one* source of responsibility.

But whether "Total Design" or "packaged," National Champions give you heat and corrosion resistant metals throughout all units . . . gas, oil or combination fuel burners . . . the industry's largest selection of models and sizes to fit *every* heating requirement.

Before *you* specify, check National and . . .

select with confidence!

NATIONAL HEATER CO.

2475 DOSWELL AVE. • ST. PAUL, MINN. • Midway 6-9631

Babbitt

Adjustable

SPROCKET RIM

with Chain Guide

Changes that Danger Zone to a

SAFETY ZONE

The distance between the floor of your plant and your overhead valves is a DANGER ZONE when piled up boxes or even ladders are used to reach the valves.

Turn it into a SAFETY ZONE — equip your overhead valves with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. If your supplier does not carry them, contact us direct.

Babbitt 166-9

STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

EQUIPMENT DEVELOPMENTS

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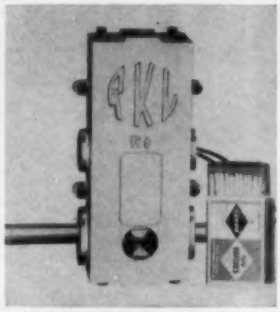
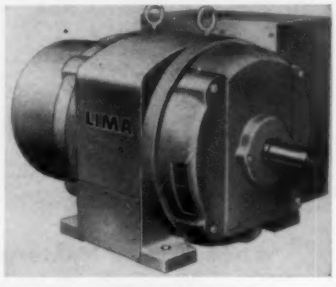


Pinch-Type Valve . . .

. . . solenoid-operated, for metering, sampling, control applications involving fluids, slurries, etc., said to provide gas-tight shutoff; consists of rubber body which is pinched closed by spring-loaded solenoid mechanism; unit is normally closed, opens upon energization, is controlled manually or by various automatic devices; in sizes from 1/16 to 1 in., corresponding to standard metal tubing sizes, uses 110 v, 60 cycle power —*RKL Controls, Inc., Hainesport Industrial Park, Hainesport, N.J.*



Electric Motors . . .

. . . and motor generators in ratings from 5 to 100 kw, with open type construction and static exciter-regulator, feature inherent regulation to ± 10 percent or magnetic amplifier regulation to ± 1 percent; "special brushless" generators with dripproof construction available for engine mount or direct coupling to driving motor, rated as above, are equipped with induction-exciter-regulators for inherent regulation with no external controls; all ratings at 1800 rpm—*The Lima Electric Motor Co., Inc., Dept.* 519, *Lima, O.*

Install Insulation with

TUFF-BOND

Super-Strength Adhesives

TUFF-BOND #6
. . . non-flammable fire-retardant adhesive for installing insulation

TUFF-BOND #7
. . . fire-retardant adhesive for installing insulation

TUFF-BOND M-102-H
. . . duct liner adhesive

TUFF-BOND 21-C
. . . clear lap sealer and lap adhesive

TUFF-BOND 21-W
. . . white lap sealer and lap adhesive

TUFF-BOND #500
. . . exceptionally high-strength chemical-set adhesive. Wide thermal range —100° F. to 350° F.

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. . . high heat resistance for bedding and installing high temperature insulation

TUFF-BOND #12
. . . high pressure duct sealer

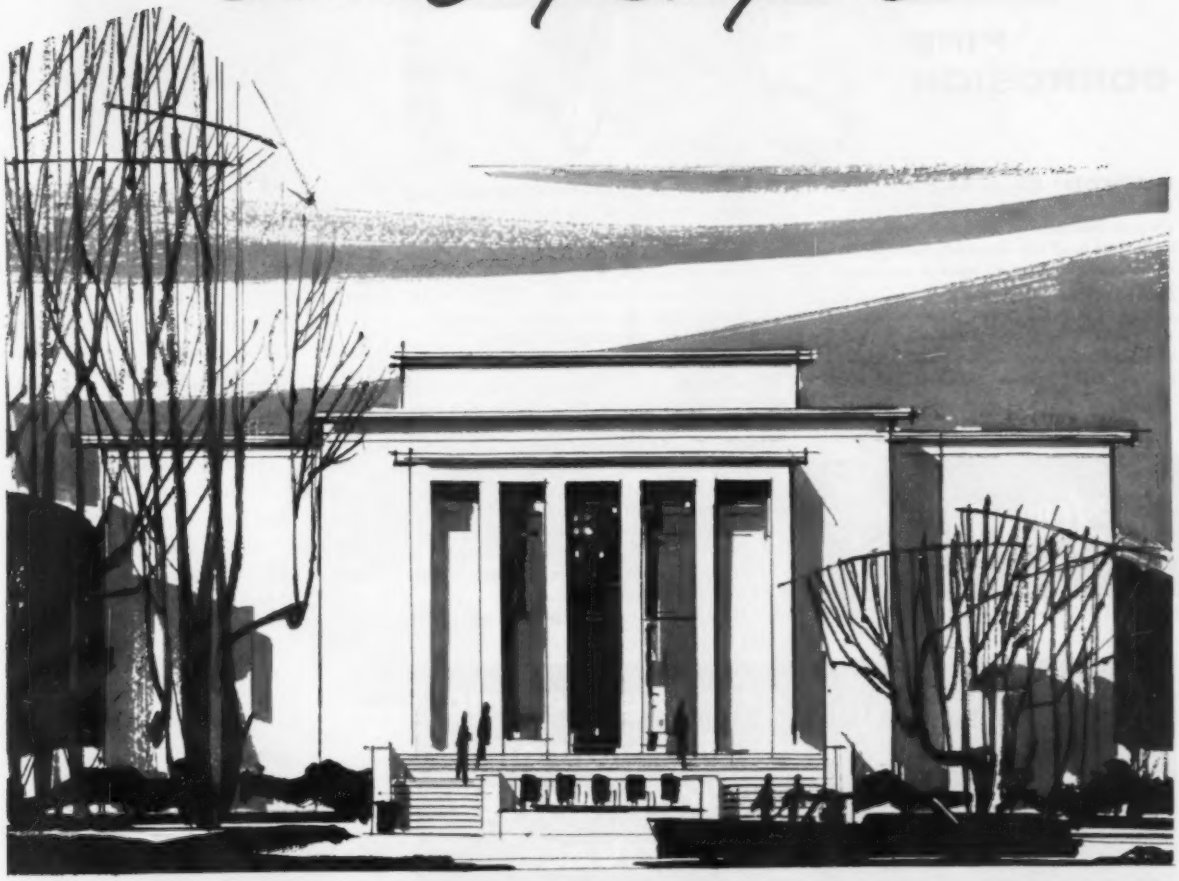
TUFF-BOND QUIK SET
. . . neoprene-base, fast-setting adhesive. Recommended for installing metal and nylon hangers to smooth surfaces.

TUFF-BOND GENERAL PURPOSE IMPROVED
. . . all-around adhesive for installing insulation, insulation hangers, etc.

Ask for literature and prices.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 26, ILLINOIS

Climate by Chrysler



South Carolina Archives Building, Columbia, S. C. **Architect:** G. Thomas Harmon, and Assoc.; **Consulting Engineer:** Watson Engineering Co.; **General Contractor:** Atlantic Building Co.; **Air Conditioning Contractor:** Columbia Heating and Cooling Co.

Chrysler Air Conditioning controls humidity within 2% to preserve treasured archives

Some old, some new—but of South Carolina's historical records and documents available you'll find many of them in the state's new Archives Building. All are preserved for future generations in climate created by Chrysler.

The air conditioning divides into two separate air systems: a high-pressure system for comfort cooling—a low-pressure system for humidity control in storage areas. A 60-ton Chrysler Radial Chiller cools with a flexibility that allows an accurate 50% relative humidity so necessary in eliminating the deterioration and brittleness which age brings to paper. Control is so precise, humidity never varies more than 2%.

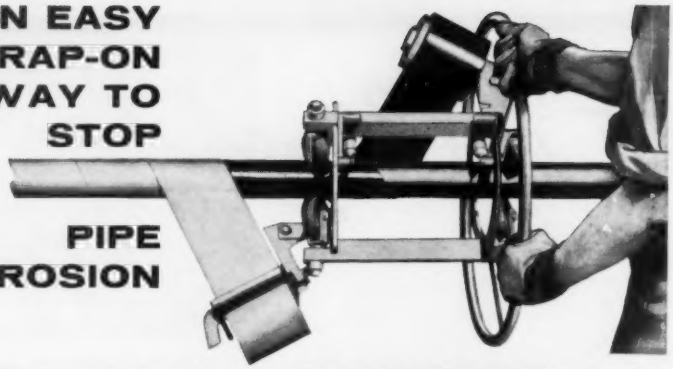
Total installed cost of the entire air conditioning system: only $1.40 per square foot of area. (Actually, cost was 8% below original expectations!)

Economy is reason enough for choosing Chrysler Air Conditioning, but only one of many advantages. Another is the cooperation given consulting engineers and contractors by Chrysler engineers. For the whole story, for information on Chrysler equipment and engineering assistance, write today.

CHRYSLER AIRTEMP

Airtemp Division, Chrysler Corporation, Dept. Y-70, Dayton 1, Ohio
In Canada: Therm-O-Rite Products, Ltd., Toronto, Ontario

AN EASY WRAP-ON WAY TO STOP PIPE CORROSION



CHASEKOTE* Pressure-Sensitive Polyethylene Tape has an extra-heavy adhesive mass that clings to clean pipe on contact . . . makes a perfect, permanent bond that rustproofs, waterproofs and insulates pipe against all types of corrosion.

CHASEWRAP* Protective Overwrap is a tough, wrinkle-free outerwrap that shields against abrasion, wear, and physical damage to the tape. Wraps simultaneously with the tape. Superior to rag and felt wraps, yet far lower in cost.

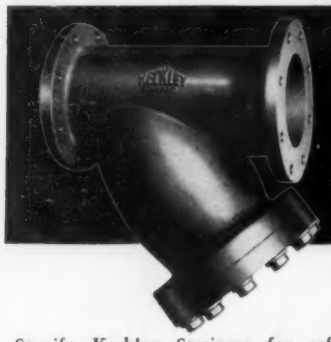
**Trade name of Chase & Sons, Inc., long-famous for protective and insulating tapes for electrical wire and cable.*

CORR-PREV DIVISION

The new CORR-PREV Pipe Coating Team comes in easy to handle tape form. It goes on pipe faster and lasts longer than corrosion-proof paints. It's cleaner and simpler to apply, too, than hot tar coats. And most important, this new CORR-PREV Team offers all the cost-cutting, pipe-saving advantages of polyethylene tape.

With CHASEWRAP Abrasion-Resistant Overwrap and Chasekote polyethylene tape, you get the easiest and best pipe protection at lowest applied cost! There's no heating, drying, clean-up or shut-down time. Each roll is factory-uniform in thickness and quality. And all coating materials — including rental of high-speed applicators — are available from one reliable source. Want samples? Specs? Prices? Write **CHASE & SONS, INC., 26 Spruce Street, North Quincy, Massachusetts.**

FOR YOUR ELECTRICAL INSULATION PROBLEMS SPECIFY CHASE FRICTION, PLASTIC, RUBBER, NEOPRENE & BUTYL TAPES



Processing, heating and air conditioning FOREIGN MATTER REMOVAL!

Specify Keckley Strainers for safe, sure removal of foreign matter from distribution systems — *ahead* of pre-heat and re-heat coils, control valves, steam traps, pumps and other equipment.

Assure your next processing, wet heat or air conditioning installation of maximum performance with Keckley Strainers — the best performance insurance you can buy.

Write for your copy of catalog 58-A showing Keckley's complete line of steam and liquid control equipment.

Y-Type Self-Cleaning Strainers

In ¼" to 12" pipe sizes in semi-steel bodies to 250 lbs. steam, bronze bodies to 300 lbs. steam, and cast steel bodies to 600 lbs. steam. Screwed or flanged connections. All size perforated brass, stainless steel or monel screens available, as well as wire meshes, for proper media selection.

Basket Type Strainers

For pressure and suction pipe lines. Basket lifts from top, cleans easily. Semi-steel bodies to 250 psi, bronze bodies to 300 psi, and steel bodies to 600 psi. Brass or stainless steel screens. Also available with vertical blow down.

O. C. KECKLEY COMPANY

General Offices and Factory

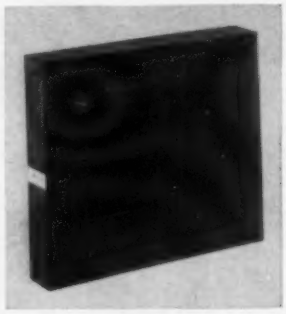
3400 CLEVELAND ST., SKOKIE, ILLINOIS

KECKLEY

Pressure Regulators • Temperature Regulators • Float Valves
Strainers • Solenoid Valves • Reducing Valves
Pop Safety Valves • Relief Valves

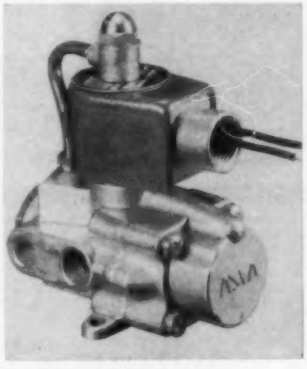
EQUIPMENT DEVELOPMENTS

Continued



Back-Draft Dampers . . .

. . . for ventilation and air conditioning systems, with blades constructed of either synthetic rubber over synthetic fabric or plastic coated glass fabric; design said to afford 75 percent free area, positive closing; available in all sizes for high or low velocity systems, with frames furnished in prime coated steel, special baked coatings, or stainless steel; bulletin "105" available upon request—*Airflow Controls Co., 621 W. Lake St., Minneapolis 8, Minn.*

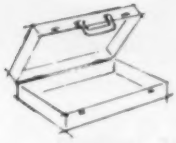


Solenoid Valve . . .

. . . with ¼ or ⅜ in. pipe connections, ¼ in. orifices, for air, water, or oil operation at pressures to 250 psi, temperatures to 212 F; with forged brass body, poppet type seat and disc; main valve discs are power driven in both directions, have no return springs; valve can be mounted in any position, is available in all standard voltages; bulletin "8344" available upon request —*Automatic Switch Co., Florham Park, N.J.*

A. O. SMITH HAS THE HORSES...

HURDLE THORNY APPLICATION PROBLEMS



From the case of the A. O. Smith Motor Man

...a line of 800 to 1 hp favorites, built to make tough application problems seem easy

When it comes to building integral-motor-powered equipment, *make sure of your horsepower source!* Before you specify any motor brand, consult with your A. O. Smith Motor Man. He'll show you how the horses of A. O. Smith (single-phase integrals — 1-5 hp — polyphase — 1-800 hp) help users surmount application barriers.

And A. O. Smith delivers the horses that deliver the goods!

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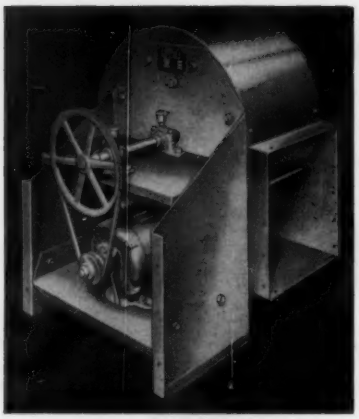
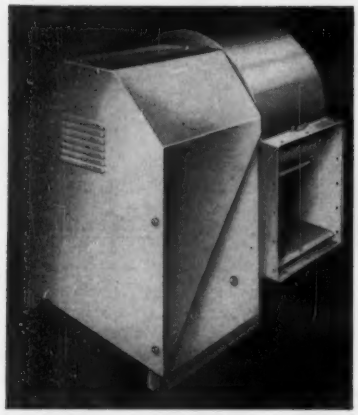
ELECTRIC MOTORS
Tipp City, Ohio

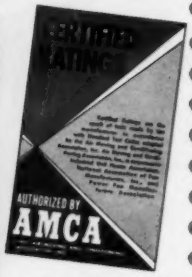
A. O. SMITH INTERNATIONAL S. A.
Milwaukee 1, Wisconsin, U. S. A.



Aladdin
AIR HANDLING EQUIPMENT

UTILITY SETS





TEN SIZES • COMPACT • BELT DRIVEN
SELF CONTAINED • QUIET OPERATING

ALADDIN Belt-Driven Utility Sets are extremely quiet in operation. Designed for general ventilation, they occupy a minimum of space, handling large volumes of air at low noise levels. They are ruggedly built and are ideally suited for roof installation . . . when furnished with weatherproof cover they require no further protection against the weather.

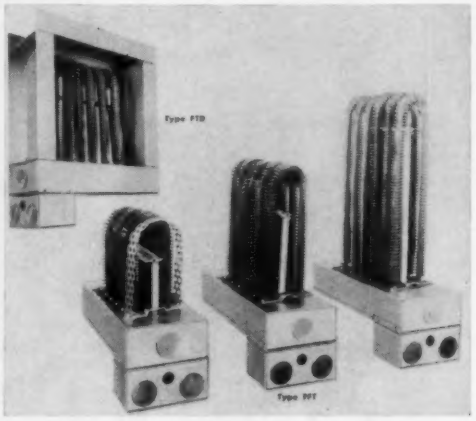
ALADDIN Utility Sets are available with both forward curved or backwardly inclined blade wheels.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

EQUIPMENT DEVELOPMENTS

Continued

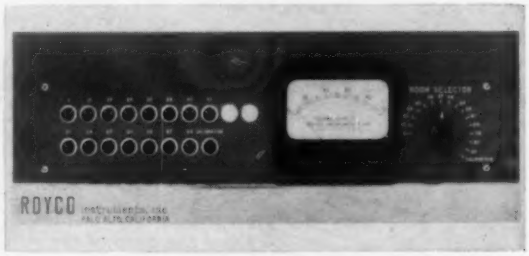


Duct Heaters . . .

. . . electric, for installation in new or existing ductwork, in 2 to 100 kw capacities at 120 to 550 v, feature metal-sheath element with ceramic coating, corrosion-resistant terminal boxes, spot welded frames; standard sizes are stocked and special sizes available up to 28 by 48 in. duct size, according to manufacturer — *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*

Digital Calculator . . .

. . . pocket sized, 6-½ in. in diameter, yields multiplication, division, reciprocals, proportions, squares and square roots, cube and cube roots, circumference and area, includes conversion tables for metric, kilowatt, hp, liter, Btu, joules and area computing; circular rule said to be unbreakable—*Bolind, Inc., Boulder 15, Colo.*



Temperature Monitor System . . .

. . . for centralized observation of ambient temperatures in a number of areas; available temperature range is −50 F to 300 F; panel contains selector switches and confirming lights for areas monitored, with all readings appearing on single scale; sensor probes with plug terminals available with extension cables for runs as long as 4000 ft; cables plug directly into rear of indicating panel, calibration switch is also included; operates on 115 v 60 cycle current, with 4 w power consumption — *Royco Instruments, Inc., 365 San Antonio Rd., Mountain View, Calif.*

New! Proven! Approved! National Airoil Type C-45 PACKAGE Oil Burner

Pressure Atomizing Burner specially engineered and approved by Underwriters' Laboratories for use with Nos. 4 and 5 commercial fuel oils

QUIET HEATING AT LOWEST COST IN BUILDINGS REQUIRING UP TO 12,000 SQUARE FEET OF RADIATION

RUGGED DESIGN AND PRECISION CONSTRUCTION

EASY TO INSTALL—MINIMUM INSTALLATION COSTS

EASY STARTING, HIGH TEMPERATURE FLAME, GOOD COMBUSTION

SPECIALLY DESIGNED FOR USE IN STANDARD FIRE BOX BOILERS OR IN THE LATEST TYPE SELF-CONTAINED BOILERS FOR NATURAL OR INDUCED DRAFT OR "PRESSURIZED"

EXCELLENT REPLACEMENT FOR LIGHT OIL BURNERS UP TO 33 GPH

UNIT CAN BE INSTALLED TO USE LIGHT OIL WITHOUT PLACING ELECTRIC OIL HEATER IN SERVICE

CHANGE CAN BE MADE TO NO. 4 OR 5 OIL AT ANY TIME

CHECK THESE ADVANTAGES

- No float valves to stick open or closed.
- No oil level to maintain.
- No air compressor or multipistons to lubricate, maintain or replace.
- Simple standard parts.
- A unit that is easily understood and serviced by any good oil burner mechanic.
- As easy to install and service as a residential gun type oil burner.
- All controls, except limit switch and thermostat, are mounted in enclosed control cabinet, factory wired and tested, with terminal block coded for easy field connections.
- All air needed for combustion is furnished by burner blower—no secondary air openings are required.
- Prepurge of cold oil and delivery of hot oil, of proper viscosity, right at the nozzle, before burner start. This insures easy, smooth start every time.
- All valves and component parts are included.
- Electronic combustion safety controls, with response of 0.8 seconds on flame failure, provide utmost in safety and meet all requirements of Underwriters' Laboratories.

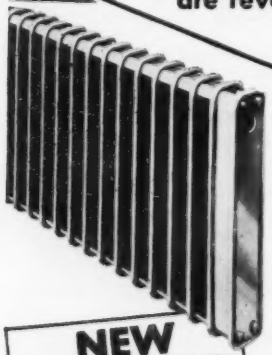
Bulletin 100 contains complete data on the Type C-45 Oil Burner in its several natural or induced draft models and pressurized model. Write for a copy today.

Established 1912
Incorporated 1917

NATIONAL AIROIL BURNER COMPANY, INC.
1284 E. Sedgley Avenue • Philadelphia 34, Pa., U.S.A.
Industrial Oil Burners, Gas Burners and Combustion Equipment

Perkins AIRadiators offer 3 big advantages for Plant-Area Heating

1 Safe heat—because it's AIRadiated wet heat
2 Out-of-traffic mounting on ceilings or walls
3 Simplified installation—tapping positions are reversible



Perkins AIRadiators operate on steam or hot water to 150 psi — there are no motors, fans, or other moving parts that can cause dangerous sparking — nothing to wear or fail. They mount easily anywhere on ceilings or walls, away from equipment and traffic. Reversible tapping locations assure simplified installation in either new or existing piping layouts.

Perkins AIRadiators are made in sizes to meet every heating requirement, distribute an exact ratio of radiant and convected heat. Of rigid integral steel and copper construction, they last a plant's lifetime.

NEW CATALOG
Full Information on complete line of SHAW PanelVectors and PERKINS AIRadiators
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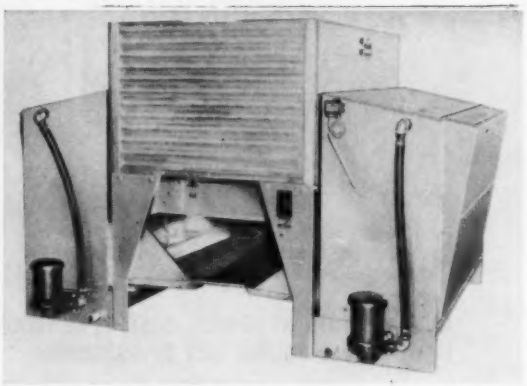
SHAW PERKINS MFG. CO.
Properly Designed Room Heat Distribution Equipment
201 E. CARSON ST., PITTSBURGH 19, PENNA.

EQUIPMENT DEVELOPMENTS

Continued

Heat Exchanger . . .

. . .of double-pipe design requires only two ¾ in. steel studs each for tubeside connection and tubeside closure; units are designed so that tube element can be pulled out from shell; furnished with outlet and inlet shell and tube flanges for ease of installation; standard 3 in. exchangers made for pressures of 5 to 600 psi, with higher pressure types available; tubes and fins available in carbon steels, stainless, nickel, monel, chrome-moly alloys, and others; bulletin "110" available upon request — *Brown Fintube Co., 300 Huron St., Elyria, O.*



Air Cooled Condenser . . .

. . . with auxiliary equipment designed to provide controlled condensing temperatures and pressures under all dry bulb conditions; system consists of air cooled condensing unit, pressure controlled damping system, and air precooler — a spray unit to reduce dry bulb temperature of entering air; system has automatic controls; manufacturer states application allows selection of air cooled condenser in areas of high peak temperatures on basis of lower design dry bulb temperature; bulletin "DCR-60" available on request — *The Marley Co., 222 W. Gregory Blvd., Kansas City 14, Mo.*

Year 'Round Air Conditioning Unit . . .

. . .in six sizes for gas or oil firing in 150,000 to 1 million Btu output, designed to accommodate any standard make of cooling equipment from 2 to 40 tons with air or water-cooled condensing units; available as complete package or for later cooling addition, with enclosed housing, keylocked doors, two sets of dampers for air mixture from 100 per cent outdoor to 100 per cent return; designed for rooftop mounting—*The Mammoth Furnace Co., 6425 Cambridge Ave., Minneapolis, Minn.*

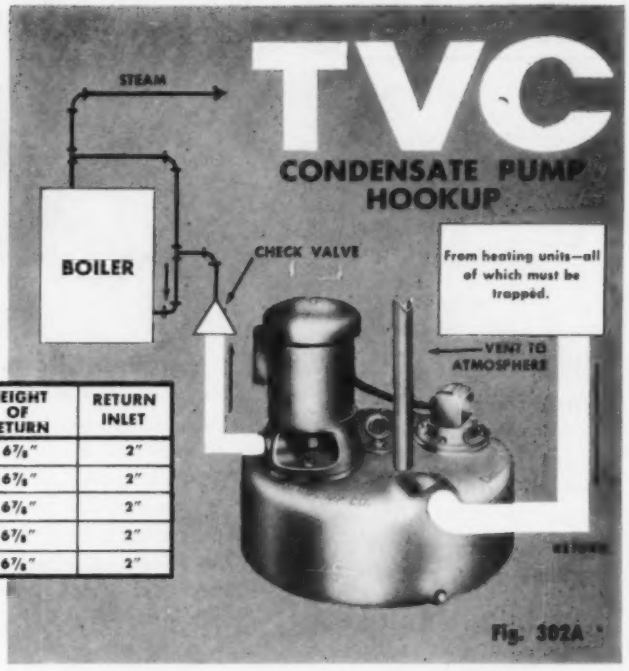
the weil LOW RETURN CONDENSATE PUMP

with
- LOW RETURN CONNECTION
- CAST IRON RECEIVER
- 1750 RPM MOTORS

UNIT NO.	SQ. FT. E.D.R.	CAP. G.P.M.	H. P.	PUMP DISCH.	HEIGHT OF RETURN	RETURN INLET
TVC 19	750	1.5	¼	1"	6⅞"	2"
TVC 23	1000	1.5	¼	1"	6⅞"	2"
TVC 29	2000	3.0	¼	1"	6⅞"	2"
TVC 35	4000	6.0	¼	1"	6⅞"	2"
TVC 41	6000	9.0	½	1"	6⅞"	2"

Discharge pressure: 20 lbs. P.S.I.

Low speed (1750 RPM) assures long life and the float switch control built into this unit means trouble-free service. See Sweet's Catalog or send for Bulletin TVC-300 for full specifications and pumps with capacities to 15,000 sq. ft. EDR.



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SEND FOR BULLETIN TVC-300.

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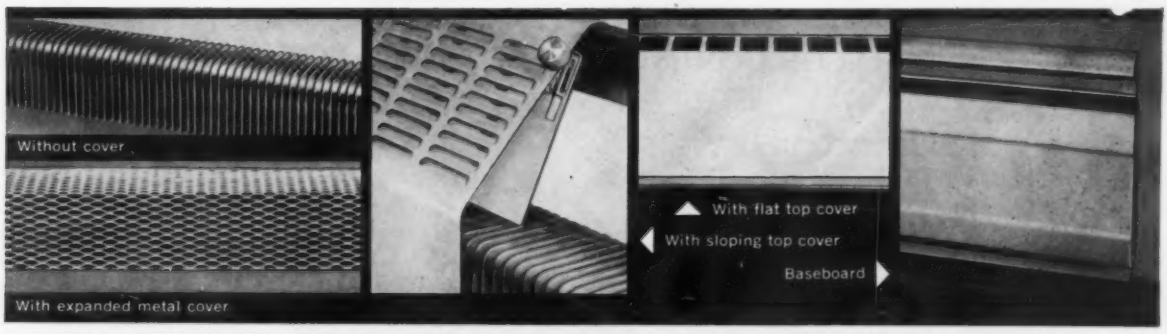

32 different copper and steel heater elements to choose from in the complete SARCOfin line.

Choose the finned tube radiation that best meets your requirements—from the complete Sarcofin line. Choice of 32 different heating elements. Eight types of enclosures: flat-top, expanded metal, sloping top, modified flat top, sill-type and three baseboard cover types.

And for old or new homes, remember the variety, flexibility, and easy installation of Sarco-Pak baseboard radiation.

All ratings are approved under the I-B-R code. For your extra convenience, standard length "packages" are now available. Superb appearance matches high Sarco quality.

You always get the advantage of single-source responsibility, when you specify Sarco-Sarcotherm for all your finned-tube radiation, heating specialties, pumps, regulators, and weather-compensated control systems. Write for your copies of latest bulletins on Finned-Tube Commercial Radiation and Baseboard Radiation.

2363

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635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

EQUIPMENT DEVELOPMENTS
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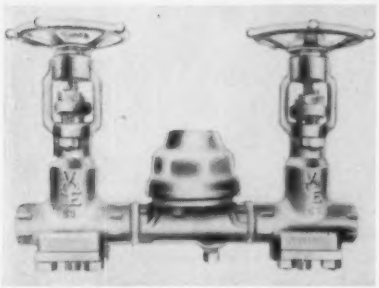
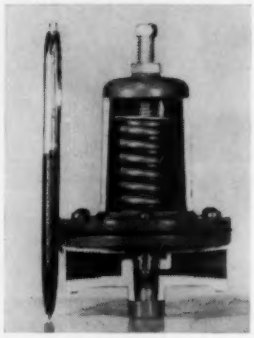


Steam Trap . . .

. . .with one or two integral forged steel gate valves supplied as unit for ease of installation, repair and inspection; in ⅜ to 1 in. connection sizes for pressures to 150 psi, other models for up to 2000 psi, 1050 F; one piece cage contains all internal trap parts which may be replaced without breaking line connection; valves are bonnetless design with stainless steel seats; catalog "200" available upon request—*Velan Steam Specialties Inc., 37 South River St., Plattsburg, N.Y.*

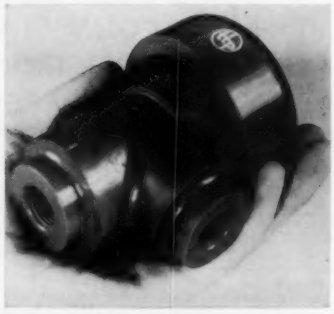


Instrument Regulator . . .

. . .for controlled air or gas pressure supply to pneumatic tools, controlling instruments, etc.; constructed of die cast aluminum, has maximum inlet pressure of 250 psi and outlet pressure ranges of 0 to 5, 5 to 35, and 35 to 100 psi—*Rockwell Mfg. Co., Meter and Valve Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.*

Gate Valve . . .

. . .of union bonnet bronze construction for 125 to 150 psi applications; features reinforced body, cylindrical body neck section, double wedge disc and rising stem; other models with solid wedge disc and rising stem or single wedge disc, non-rising stem — *Lunkenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14, O.*



Vacuum Breaker . . .

. . .plastic, in ⅜, ½, and ¾ in. nominal pipe sizes used to prevent back flow in high purity piping systems, with movable plastic disc, removable cap to prevent fouling from exterior sources — *Tube Turns Plastics, Inc., 2929 Magazine St., Louisville 11, Ky.*

FOR CONVECTOR OR CONTINUOUS LINE APPLICATION

A-J

NEW NO. 800 GRILLE

An entirely new conception of a linear strip grille. Here's a complete unit for virtually any required installation. Ideal for convectors — can be used in floor, wall, sills.

Pencil-proof face grille of steel, aluminum, stainless or architectural bronze. All-steel setting frame, tailored for each unit, and furnished with anchoring straps for quick and easy installation. Adjustable louver bars in single or double banks provide deflection patterns. Face grille reduces unauthorized tampering of air flow pattern and volume. All-steel opposed blade dampers optional.

FREE catalog contains complete identification and selection. Write for your copy.

A – J MANUFACTURING CO.

3601 E. 18th St. Dept. H-7 Kansas City 26, Mo.

RECENT TRADE LITERATURE...

▸ *ADHESIVES* — and pressure-sensitive tapes are compiled in applications directory indicating which of line of products are used for specific applications in various industries. Listings are based on classified telephone directory arrangement, include tapes, adhesives, sealants, coatings, and electrical insulating materials. *Permacel, New Brunswick, N.J.*

▸ *AIR AND VACUUM PUMPS* — described in catalog "460" which covers rotary positive air pressure and high vacuum pumps, gas boosters, and air motors, with construction, dimensional, capacity details, performance curves and application data. *Leiman Bros., Inc.*, 102 *Christie St., Newark* 5, *N.J.*

▸ *AIR FILTER* — bulletin "B" covers cube type replacement unit said to reduce filter bank face area by 50 percent; with exploded-view illustrations, arrangement diagram, capacity and resistance table. *Union Carbide Development Co.*, 30 *E.* 42*nd St., New York* 17, *N.Y.*

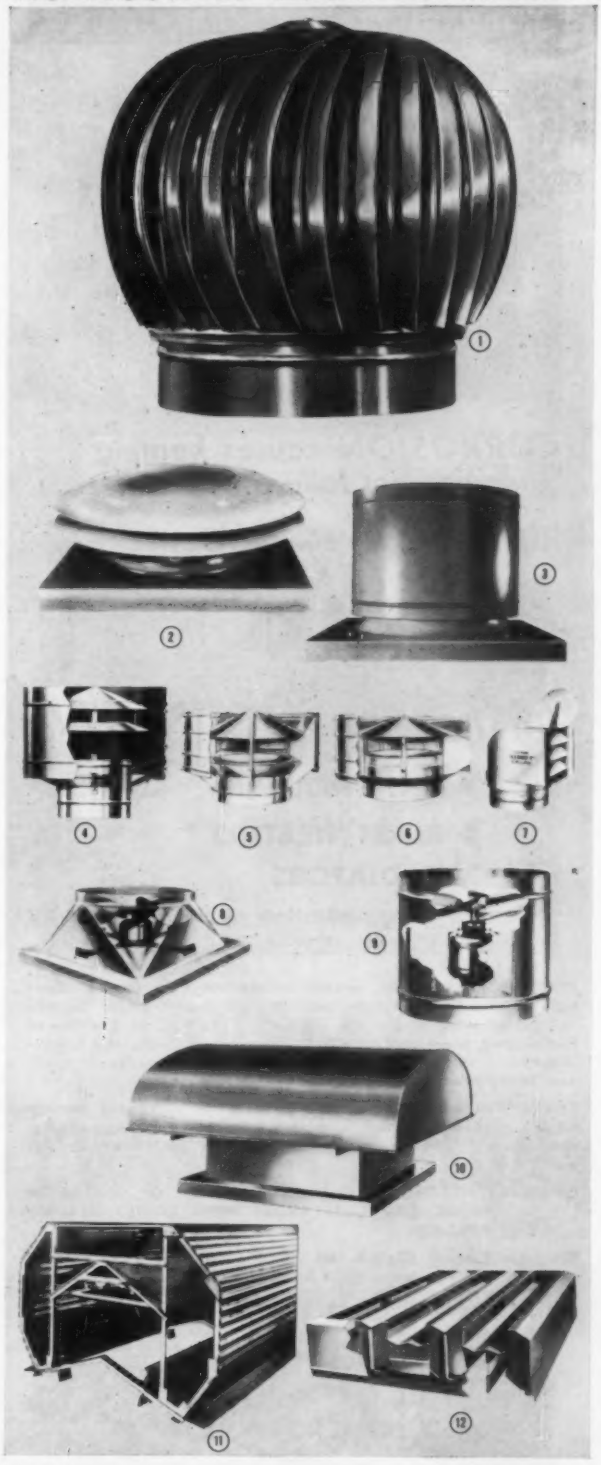
▸ *ARC WELDING ELECTRODES* — pocket-size card gives application information on mild steel arc welding electrodes and describes how to identify each type by AWS-ASTM classification. *Hobart Bros. Co., Troy, O.*

▸ *ARC WELDING* — line of manual, semi-automatic, and automatic tungsten inert gas welding process equipment described in catalog "2300" with information on accessory equipment, electrodes, and filler wires. *Air Reduction Sales Co. Div., Air Reduction Co., Inc.*, 150 *E.* 42*nd St., New York* 17, *N.Y.*

▸ *BELLOWS METER* — indicating type, described in specification "S224-1"; unit said to be suitable for any flow, open or closed tank liquid level application not requiring recording or data transmission. *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia* 44, *Pa.*

▸ *BOILER CATALOG* — features packaged Scotch-type 3-pass unit designed for commercial and institutional buildings use with gas, oil, or combination burners. *Burnham Corp., Heating & Cooling Div., Irvington, N.Y.*

No Need to Look Further...



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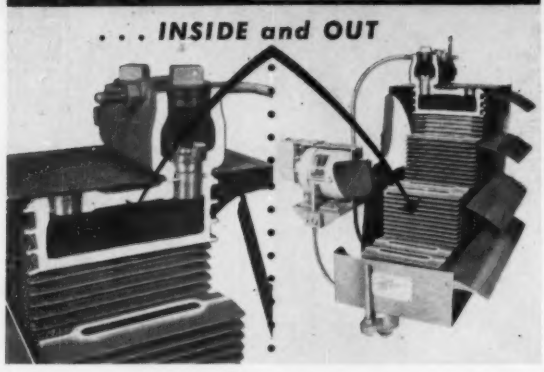
it's the material that makes the difference . . .

. . . INSIDE and OUT



CORROSION causes heating equipment failures!

BUT NOT WHEN YOU USE

GRID

cast iron construction

- UNIT HEATERS
- BLAST HEATERS
- RADIATORS

Designed for operation on steam pressure up to 250 PSI 450° temperature

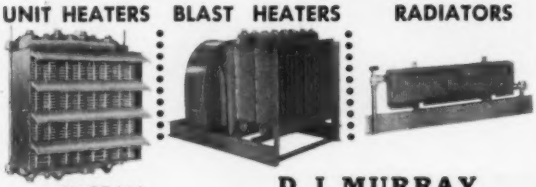
CORROSION internally, caused by electrolytic action is eliminated because all metals in GRID Cast Iron Transfer Surface in contact with steam are similar . . . not 2 or 3 different metals that promote CORROSION that causes leaks and breakdowns . . . do away with high maintenance costs, repair work, and leaky heating equipment.

CORROSION externally caused by acid fumes cannot destroy GRID's cast iron finned heating surface. Widely spaced fins cast integral with the steam chamber will not corrode externally.

ORDINARY HEATING SURFACES FAIL BECAUSE OF CORROSION INSIDE AND OUT! AVOID THESE COSTLY HEATING FAILURES!

Send for Catalog 936R-4-160 . . . The complete story on Grid Unit Heaters, Blast Heaters and Radiators.

UNIT HEATERS BLAST HEATERS RADIATORS



INSTALL GRID CAST IRON

D. J. MURRAY MANUFACTURING CO.

Manufacturers Since 1883

WAUSAU, WISCONSIN

OFFICES IN PRINCIPAL CITIES

RECENT TRADE LITERATURE

Continued

▸ *CENTRIFUGAL FANS* — covered in catalog "1120-1" feature flat, backward inclined blading, are suitable for supply and exhaust, ventilation, air conditioning, industrial process, other applications. Booklet is illustrated, contains tabular performance data and dimensions for AMCA Class 1, 2, and 3 fans. *Westinghouse Sturtevant Div., 200 Redville St., Hyde Park 36, Mass.*

▸ *CHECK VALVES* — for boiler feed lines, steam pumps, compressors, reciprocating pumps handle water, gas, oil, other fluids, and are detailed in bulletin "WS-1A". *Golden Anderson Valve Specialty Co., 1210 Ridge Ave., Pittsburgh 33, Pa.*

▸ *CIRCUIT BREAKER LOAD CENTERS* — described in bulletin "GEA-7071" which provides descriptive information, specifications, on line extending from 2 to 40 circuits, 40 to 200 amp, in flush, surface, and "raintight" enclosures; features 100 amp, 2-pole, plug-in circuit breakers, and non-interchangeable breakers. *General Electric Co., Distribution Unit, Plainville, Conn.*

▸ *CLAMPS* — for hose, flexible plastic pipe, duct connections, custom applications described and illustrated in new booklet. *Wittek Mfg. Co., 4305-43 West 24th Place, Chicago 23, Ill.*

▸ *COMBUSTION CONTROL SYSTEM* — meters both fuel and air flow, is said to provide up to 10 to 1 firing range with high efficiencies, for use on packaged boiler, other installations, is described in bulletin "VO-60". *Coen Co., Inc., 40 Boardman Place, San Francisco 3, Calif.*

▸ *COMMERCIAL KITCHEN VENTILATION* — manual covers requirements for effective system, design fundamentals for component parts, and effect of appliances and exhaust systems on air conditioned areas. Available for 50 cents. *American Gas Association, 420 Lexington Ave., New York 17, N.Y.*

▸ *CONDENSERS* — steel fin type, for static and forced draft applications, assembly with $\frac{3}{8}$ or $\frac{1}{4}$ in. tubing, described in new catalog which also details line of standard stocked units in seven sizes for $\frac{1}{8}$ through $\frac{3}{4}$ hp applications. *Kirsch Co., Refrigeration Div., Sturgis, Mich.*

RECENT TRADE LITERATURE

Continued

▸ *CONTROL VALVES* — series LB in ¾ through 6 in. sizes, single-seated, split body, with pneumatic cylinder actuator, choice of flange connections, piston lipseals for tight sealing described in data sheet "101" with list of optional actuators and accessories including oversize handwheel, yoke mounted pressure and temperature controllers, variety of trim materials. *Conoflow Corp.*, 2100 *Arch St., Philadelphia* 3, *Pa.*

▸ *COPPER WATER TUBE BOILERS* — form "104" illustrates with cut-away drawing packaged unit available, lists features, details 4-pass design; with specification chart. *Raypak Co., Inc., P. O. Box* 41, *El Monte, Calif.*

▸ *DIFFUSERS, REGISTERS, GRILLES* — of wide variety of types, sizes, described and illustrated in 64 page booklet with specification data, operation and installation information. *United States Register Co., Burnham St., Battle Creek, Mich.*

▸ *DUCT HEATER* — open coil electric, for new installations or in new models for slip-in to existing ductwork, stock sizes 1000 to 30,000 w, 3400 to 102,000 Btu per hr, or in custom sizes from 500 to 1 million w, 1700 to 3,412,000 Btu per hr, described and illustrated in bulletin "E-97U." *Industrial Engineering & Equipment Co.*, 24 *Hanley Industrial Ct., St. Louis* (*Brentwood*) 17, *Mo.*

▸ *ELECTRIC MOTORS* — brochure constitutes quick reference to motor and generator lines available, including 1/40 to 300 hp a-c motors for variety of applications, in several designs, plus gearmotors, speed reducers, motor-generators, other products. Bulletin "L-1661A". *Howell Electric Motors Co., Howell, Mich.*

▸ *ELECTRIC MOTORS* — a-c "multi-shielded," ¼ to 400 hp covered in catalog "200" with pricing and dimensional data, available modifications, special section on selection and applications. *Sterling Electric Motors, Inc.*, 5401 *Telegraph Rd., Los Angeles* 22, *Calif.*

▸ *ELECTRIC MOTORS AND BLOWERS* — fractional hp, plus replacement kits, brackets, fan blades, accessories, plus new products including replacement motors for air conditioning units from 1/3 through 2 hp, others; with dimensional diagrams, hp ranges, air delivery graphs. *Redmond Co., Inc., Distributors Div.*, 201 *Monroe St., Owosso, Mich.*

usAIRco

40 years experience in air handling units

Series 75 Multi-Zone Unit

RUGGED CONSTRUCTION

Built for Efficient Performance, Long Life and Trouble-Free Operation

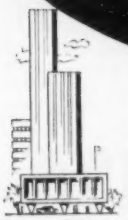
WRITE FOR PRODUCT BULLETIN 75

United States Air Conditioning Corporation
Delaware, Ohio

Sterlco®

THERMOTROL

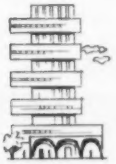
ACCURATE, INDIVIDUAL ROOM TEMPERATURE CONTROL . . . FOR STEAM OR HOT WATER SYSTEMS



Schools, Offices and Apartments

EVEN HEAT

Controls each unit of radiation independently . . . provides heat only when temperature in room or small area falls below Thermotrol setting. Eliminates thermostats and zone valves.



Institutions, Hospitals and Public Buildings

SAVES FUEL

Thermotrol installations often pay for themselves in fuel savings. Prevents overheating and waste of fuel. Excellent for correcting unbalanced systems. Heat used only when and where it is needed.

EASILY INSTALLED

Completely self-contained . . . requires no connection to power supply, or external control device. As easy to install as ordinary radiator valves.

Leaders in temperature controls since 1916

Sterling inc.

5202 West Clinton Ave., Milwaukee 23, Wis.

RECENT TRADE LITERATURE

Continued

▸ *ELECTRONIC BEAM WELDING* — form "ADC 937" describes method which welds by bombardment of metal with accelerated electrons in a vacuum chamber, said to be of particular significance with regard to new metals and alloys; with schematic drawing of electron beam gun. *Air Reduction Sales Co., Div., Air Reduction Co.* 150 *E.* 42*nd St., New York* 17, *N.Y.*

▸ *ENGINEERS MANUAL* — titled "System Design" is intended to supply data not included in texts or manufacturer's catalog; includes illustrations, charts and tables covering load estimating, air distribution, piping design. Data will be supplemented by periodic reprintings. *Carrier Corp., Carrier Pkwy., Syracuse* 1, *N.Y.*

▸ *FAN CATALOG* — describes 30 to 60 in. belt driven axial flow units with up to 85,000 cfm deliveries, includes construction features, application details, data on ventilation system design; with illustrations, engineering drawings. Bulletin "625". *Robbins & Myers, Inc., Propellair Div., Customer Service Dept., Springfield, O.*

▸ *FAN MOTORS* — shaded pole, 3-½ in. diameter, 51-frame featured in bulletin "GEC-219F" with description of lubrication system, bearing and insulation features, testing procedures, construction, service, delivery, and ordering information; also motor ratings, sizes and fan blades, operating data. *General Electric Co., Schenectady* 5, *N.Y.*

▸ *FAN PROPELLERS* — of cast aluminum for ventilating units in 2, 3, 4, and 6-blade styles, 12 to 42 in. diameters, for use with motors of 1/20 to 5 hp, 890 to 22,000 cfm, described in bulletin "AE-60." *American Equipment Co., Inc.,* 1015 *E.* 42*nd St., Indianapolis* 5, *Ind.*

▸ *FLOW CONTROL VALVE* — for precision control of oil flow to any type burner detailed in data sheet "GA704FC" with information on application, dimensional table, illustrations. *Hauck Mfg. Co.,* 124-136 *Tenth St., Brooklyn* 15, *N.Y.*

▸ *GAS BURNERS* — bulletins "G-100-B," "G-100-S," and "G-100-P" cover units with capacities up to 3,600,000 Btu per hr input, designed to complement larger sizes previously available; burners offer on-off control of fuel input, fixed air register control, electronic flame failure protection, "multi-port, multi-jet" gas manifold. *The Mettler Co., Inc.,* 1101 *Buchanan St., Rockford, Ill.*

RECENT TRADE LITERATURE

Continued

▸ *GATE VALVE* — bronze, with union bonnet, in ¼ to 2 in. sizes, with double wedge disc and rising stem, rated at 125 lb, featured in new circular with table of dimensions. *The Lunkenheimer Co., P.O. Box* 360, *Annex Station, Cincinnati* 14, *O.*

▸ *HYDRONIC ACCESSORIES* — including new circulator, flow check, air eliminator, tank drain, radiator conversion fittings, feed water pressure regulators, relief valves, low water cut-off, and tempering valves decribed in catalog "F-1000" with illustration of boiler hook-up. *Watts Regulator Co.,* 10 *Embankment St., Lawrence, Mass.*

▸ *INDUSTRIAL HOT WATER BOILERS* — in sizes of 126,000 to 5 million Btu per hr for liquids up to 600 F, designed for closed circuit applications where large volumes of hot water are required. Packaged unit featured in new brochure with description of advantages claimed, application data. *Sid E. Parker Boiler Mfg. Co.,* 2061 *E. 37th St., Los Angeles* 58, *Calif.*

▸ *INDUSTRIAL AIR CONDITIONING* — treated in investment booklet titled "Will Factory Air Conditioning Pay Off For Me," which presents four check figures with which to qualify any operation. *Carrier Corp., Carrier Pkwy., Syracuse* 1, *N.Y.*

▸ *INDUSTRIAL VENTILATING EQUIPMENT* — for use in corrosive atmospheres, including glass fiber duct fans, other types, plus information on optional materials and coatings which may be used to adapt other units of the line to corrosive applications. *Hartzell Propeller Fan Co., Piqua, O.*

▸ *INSULATED PREFABRICATED CONDUIT* — for underground piping consists of insulation material plus asbestos-cement outer casing, with alignment guides, end seal discs and casing all non-metallic, dielectrically isolated anchor bolts for immunity to electrolytic action; described in new bulletin with cutaway drawings, diagrams, recommended specification. *H. W. Porter & Co., Inc.,* 825 *Frelinghuysen Ave., Newark* 12, *N.J.*

FOR MAXIMUM HEATING
OR EXHAUSTING EFFICIENCY
AT LOWEST COST

Patents 2,722,372 and 2,855,874 and Patents Pending plus Exclusive Foreign Patents.

...Specify

Quickdraft

POWER-DRAFT UNITS
DESIGNED FOR RESIDENTIAL,
COMMERCIAL AND INDUSTRIAL
APPLICATIONS

★ No motors, fans or bearings in exhaust line ★ Needs no stacks ★ Acid-resisting vitreous enamel finishes ★ Extremely high static pressures now available

FOR HEATING PLANTS AND INCINERATORS . . . *Quickdraft* provides constant draft for efficient and economical combustion. It eliminates pulsating or chattering, puffing, smoking and sooting. Costly, tall, unsightly stacks are unnecessary.

FOR INDUSTRY . . . *Quickdraft* now offers extremely high static pressures for EXHAUSTING corrosive gases, abrasives and paint sprays . . . for CONVEYING all types of bulk materials or wastes that can be moved by air.

FOR MOVING AIR in or out of buildings through ducts . . . *Quickdraft* is outstanding in performance and efficiency.

9010-QD

IMPORTANT NOTICE

To withstand corrosive gases, all *Quickdraft* units are available in standard acid-resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P. V. C.) and with plastic and Fiberglass coatings.

Write today for Quickdraft Engineering Data.

Quickdraft
CORPORATION P. O. BOX 87-K • CANTON 1, OHIO

RECENT TRADE LITERATURE
Continued

▸ *LIQUID CHILLERS* — new bulletins cover packaged units, 15 to 125 hp (ME-123), accessible hermetic chillers, 7.5 to 45 tons (ME-121) with capacity charts, heat rejection tables, engineering specifications; also folder titled "Climate by Chrysler" on entire line of applied machinery and systems, with illustrations, features, and specifications. *Chrysler Airtemp Div., Advertising Distribution Center, P.O. Box 1037, Dayton 1, O.*

▸ *LIQUID RELIEF VALVES* — and other special service types detailed in catalog "FE-138" with sizing information, capacity tables, weights and dimensions, application data, plus descriptions of other products including flexible valves, hydraulic and pneumatic test equipment, steam traps, fuel economizers. *Farris Engineering Corp., 563 Commercial Ave., Palisades Park, N.J.*

▸ *METALLIC COATINGS* — for anti-corrosion protection of mild steel by firing method without use of electric current, using nickel, copper, cobalt, molybdenum, other alloys, explained in brochure with application information, ordering data. *M. L. Sheldon & Co., Inc., 350 Lexington Ave., New York 16, N.Y.*

▸ *MOTOR APPLICATION GUIDE* — bulletin "270B" outlines electric motor line characteristics, with information on design features; encompasses 1/20 to 400 hp units, single or polyphase and d-c, lists required starting current, speed, capacity, available enclosures, performance data and available mountings for each type. *Century Electric Co., 1806 Pine St., St. Louis 3, Mo.*

▸ *OIL BURNERS* — and water heaters featured in pocket-size handbook with engineering and operating data, specifications, dimensions, nozzle recommendations, fan and air cone dimensions, wiring diagrams, control data, parts list and sizing tables. *The Carlin Co., Wethersfield 9, Conn.*

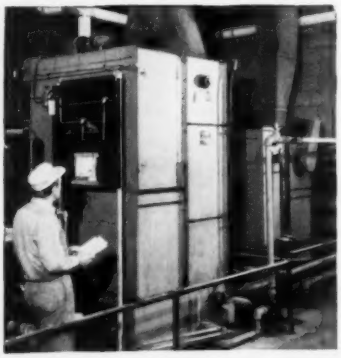
▸ *PACKAGED HOT WATER SYSTEMS*—for schools, apartment buildings, restaurants, industrial uses, described and illustrated in form "105A" with diagrams of various types available, list of equipment included in each system, description of parts. *Raypak Co., Inc., P.O. Box 41, El Monte, Calif.*

▸ *PACKAGED STEAM GENERATOR* — described in bulletin showing 24 sizes for gas, oil, or combination firing in capacities to 60,000 lb steam per hr, pressures up to 600 psi, also special units up to 100,000 lb steam per hr, plus field erected units at twice that capacity. *E. Keeler Co., 238 West St., Williamsport 3, Pa.*

DRY and CLEAN AIR at the RIGHT TEMPERATURE

- to control your product quality
- to protect a critical operation
- to protect apparatus from moisture damage
- to DRY your material or product
- to control packing or storage conditions
- to assure precision in testing or research
- to increase air conditioning capacity

Air Condition by the NIAGARA Method Using HYGROL Liquid Absorbent



This compact method, giving high capacity in small space, removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the air.

Most effective because... it removes moisture as a separate function from cooling or heating and so gives a precise result, and always. Niagara machines using liquid contact means of drying air have given over 20 years of service. The apparatus is simple, parts are accessible, controls are trustworthy.

Most reliable because... the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions... no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Most flexible because... you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Write for Bulletins 112 and 131 and complete information on your air conditioning problem.

NIAGARA BLOWER COMPANY
Dept. HP-7, 405 Lexington Ave., New York 17, N.Y.
Niagara District Engineers in Principal Cities of U. S. and Canada

EXPECTING AN ORDER?

You'll get it quicker if your postal zone number is on the order blanks, return envelopes, letterheads.

The Post Office has divided 106 cities into postal delivery zones to speed mail delivery. Be sure to include zone number when writing to these cities; be sure to include *your* zone number in *your* return address—after the city, before the state.

RECENT TRADE LITERATURE

Continued

▸ *POWER AND PROCESS PIPING* — for industrial plants described and illustrated by case history method; includes descriptions of installations in 15 industrial plants, plus section on line of welding fittings and flanges, and illustrations of quality control tests used by manufacturer. Bulletin "60B". *Midwest Piping Co., Inc.*, 1450 *South Second St., St. Louis* 4, *Mo.*

▸ *PRESSURE & LIQUID LEVEL TRANSMITTER* — for measurements of pressures as high as 250 psi, or ranges as low as 0 to 100 in. WG, transmits linear 3 to 15 psi signal to any standard receiver element, is described in bulletin "P-36-1" with illustrations of design features. *Conoflow Corp.*, 2100 *Arch St., Philadelphia* 3, *Pa.*

▸ *PRESSURE REGULATORS* — sliding gate, featured in catalog "J160-1" which describes self-operated, pilot-operated, solenoid-operated and back pressure models for use on steam, water, air, oil, gas, or corrosive chemicals; with application and construction data. *OPW-Jordan*, 6013 *Wiehe Rd., Cincinnati* 13, *O.*

▸ *RADIANT HEATING* — with gas fired units for high-bay buildings explained in brochure with listing of advantages claimed, tables of mounting heights, recommended minimum clearances, control arrangements for various fuel types. *Perfection Div., Hupp Corp.*, 1135 *Ivanhoe Rd., Cleveland* 10, *O.*

▸ *SOLDER JOINT VALVES* — gate, globe, and check, listed in circular which includes new bronze gate valve, with cutaway illustrations, instructions on making round solder joints. *Walworth Co.*, 750 *Third Ave., New York* 17, *N.Y.*

▸ *STEAM TRAPS* — brochure incorporates two bulletins on thermostatic radiator and float & thermostatic, design, materials, and construction features; four styles (corner, straightway, vertical and angle patterns) of former type included, plus eight models of latter type; with roughing-in dimensions, capacity tables. *Sterling, Inc.*, 5200 *W. Clinton Ave., Milwaukee* 23, *Wis.*

▸ *THERMAL INSULATION* — guide to use of thermal insulating materials in modern industry emphasizes "economic thickness" approach to specifications, plus economies to be gained through proper use of materials; with index to ASTM and government specifications. Titled "Re-thinking Thermal Insulation." *National Insulation Manufacturers Association*, 441 *Lexington Ave., New York* 17, *N.Y.*

This man is balancing an air flow system for the first and last time

No call backs to correct hot or cold spots when the system is set up right the first time with an

Alnor VELOMETER®

Instant reading of air flow, in feet per minute, at outlets and draw of air at returns gives an accurate check on engineered systems. The Velometer has a range from 20 f.p.m. to 3000 f.p.m. or 6000 f.p.m.

The Velometer will also give direct readings of static pressure in ducts, plenum chambers, or pipes. Registers pressure loss across heater and filters, friction loss at ells and deflectors. Many government and municipal jobs require Velometer checking before acceptance. Every air heating and air conditioning engineer on the job can save time and be sure of peak efficiency of the system by Velometer testing.

Velometer No. 3G

The Velometer, set No. 3G recommended for commercial heating and air conditioning, is priced at only $194.00 including a sturdy reinforced carrying case. Bulletin No. 2448 gives complete operating facts and various types of jets and accessories.

Alnor INSTRUMENTS

PYROMETERS — VELOMETERS — DEWPOINTERS

Illinois Testing Laboratories Inc.
Chicago 10, Ill.

Illinois Testing Laboratories Inc.,
Room 513, 420 N. LaSalle St., Chicago 10, Ill.
Please send Velometer Bulletin 2448.

Name_____

Company_____

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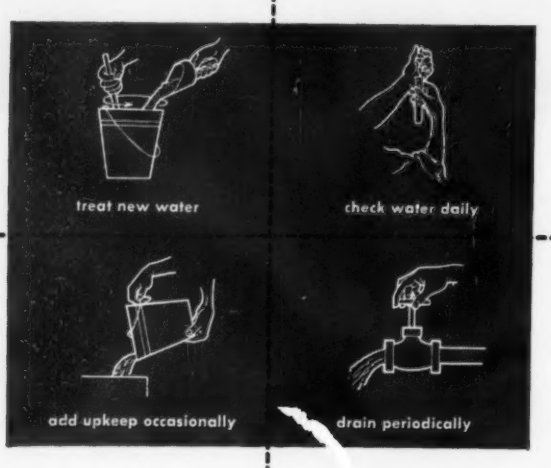
City_____ Zone____ State_____

SIMPLE—4-step water treatment IMPROVES Air Conditioning



End scale, slime and corrosion troubles in air conditioning water with Oakite Airefiner No. 52. All it takes is a ten-minute daily check up by one man. This way you maintain high cooling efficiency and you reduce out-of-service time, too.

How? With a simple four step program. (1) Charge water initially with Oakite Airefiner No. 52. (2) Test water daily. (3) Add upkeep when necessary. (4) Drain system and replace with new, charged water on a periodic basis.

That's all there is to it. Airefiner No. 52 checks slime and algae growth, prevents scale build-up and minimizes corrosion. It leaves tubes clean for efficient heat exchange. It's safe. It's inexpensive.

For explanatory drawings and full details on this time and trouble saving method, ask your local Oakite Technical Service Representative, or write Oakite Products, Inc., 51A Rector Street, New York 6, N. Y.

OAKITE

In our 51st year

specialized
WATER TREATING
materials

Technical Service Representatives in Principal Cities of U. S. and Canada

RECENT TRADE LITERATURE

Continued

▸ *UNDERGROUND INSULATION* — for steam lines and heating systems covered in bulletin featuring series of engineering drawings illustrating recommended systems, plus graphs for heat loss determination, installation and thickness specifications. *Insul-Fil Co., Inc., 250 Pettit Ave., Bellmore, L.I., N.Y.*

▸ *VARIABLE SPEED DRIVES* — in ¾ to 4 hp sizes, d-c, using wall mounted control panel-converter described in bulletin "101" with explanation of design features including line voltage compensation, zero speed start, time-rate acceleration. *The Louis Allis Co., Dept. P., 427 E. Stewart St., Milwaukee 1, Wis.*

▸ *UNIT VENTILATOR CONTROLS* — two brochures titled "Will Our School Provide the Climate for Learning?" (F-9767) and "There's No Need For Sweaters," (F-9797) respectively, discuss unit ventilator control systems for face and by-pass units, and valve-controlled systems utilizing transistorized package controls. *Barber-Colman Co., 1300 Rock St., Rockford, Ill.*

▸ *VIBRATION CONTROL SPECIFICATIONS* — for air conditioning and related equipment; guide to writing specifications presented in bulletin "F2D" which discusses factors involved in selection of resilient mountings under existing conditions; illustrated, showing type of mounting to use for various problems. *The Korfund Co., Inc., 48-01F 32nd Place, Long Island City 1, N.Y.*

▸ *WASTE HANDLING PUMPS* — eleven types of equipment for handling liquids, slurries, gases, and solids described from applications standpoint in bulletin "2305," with selection guide correlating waste viscosity, corrosiveness; volatility, and solid characteristics with pump capacities, discharge heads, and design; includes pneumatic units, rotary compressors and vacuum pumps, vertical, submersible, and horizontal units. *Yeomans Brothers Co., 1999 N. Ruby St., Melrose Park, Ill.*

▸ *WATER HEATERS* — in nine models, 180,000 to 1,800,000 Btu per hr input featured in pamphlet which points out special features, includes cutaway drawings showing fire tube construction, water leg and integrated burner design, plus automatic safety control. Units are gas fired. *Commercial Heater Co., 3020 Galvez, Ft. Worth 11, Texas.*

RECENT TRADE LITERATURE

Continued

▸ *WELDED STEEL PIPE* — bulletin "509" describes various uses ranging from heating and sprinkling systems to snow melting, ice rinks, others, with illustrations of 20 applications and manufacturing-testing procedure; with specification tables for three weights of ⅛ in. to 12 in. pipe and couplings in black iron and galvanized. *The National Supply Co., Gateway Center, Pittsburgh* 22, *Pa.*

▸ *WELDED STEEL TUBING* — technical bulletin containing quick reference weight chart for square and rectangular varieties plus comprehensive listing of tolerances for twist, straightness, cutting length, corner radii, and diagonal dimensions. *The Standard Tube Co.,* 24400 *Plymouth Rd., Detroit* 39, *Mich.*

▸ *WELDING FILLERS* — for all wrought alloy parent metal combinations listed in selection chart with correlation to service requirements; fillers are rated as to requirements, ease of welding, strength, corrosion resistance, service at high temperatures, and ductility. *Aluminum Company of America,* 743 *Alcoa Bldg., Pittsburgh* 19, *Pa.*

▸ *WELDING FITTINGS* — seamless-type, illustrated in bulletin "60-C" with general descriptions of fittings, manufacturing operations, dimensional and metallurgical control processes employed and testing procedures used; includes size ranges, examples of special fittings. *Midwest Piping Co., Inc.,* 1450 *South Second St., St. Louis* 4, *Mo.*

▸ *WELDING FITTINGS* — catalog "H-2" features line of steel units for Schedule 40 piping, with illustrations of completed installations, plus description of new eccentric reducers in 1 × ¾ through 6 × 4 in. size range; also lists other fittings available, including concentric reducers, elbows, straight and reducing tees, and incorporates flow charts, performance data, material specifications, physical properties and suggested working pressures. *Nibco, Inc., Elkhart, Ind.*

▸ *WELDING FITTINGS* — for nuclear piping and other applications described and illustrated in bulletin "60-A" with description of special fabrication facilities, illustrations of nuclear piping installations. *Midwest Piping Co., Inc.,* 1450 *S. Second St., St. Louis* 4, *Mo.*

▸ *WROUGHT IRON & STEEL CORROSION* — report contains data obtained from 8-year tests of structural materials in salt and fresh water, with comparative corrosion-time curves, weight loss tables, and test condition discussion. *A. M. Byers Co., Engineering Service Dept., Clark Bldg., Pittsburgh* 22, *Pa.*

LARGE OR SMALL

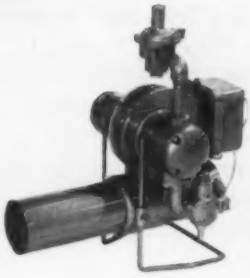
LO-BLAST

POWER GAS BURNERS

SAVE MONEY

THE *ECONOMITE* FOR RESIDENTIAL INSTALLATIONS

Capacities from 75,000 to 700,000 BTU/hr. input.



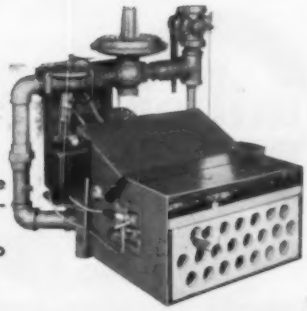
THE STANDARD Lo-BLAST

Capacities from 100,000 to 20,000,000 BTU/hr. input.

THE DUAL FUEL Lo-BLAST

The finest gas burner... the finest oil burner now combined in one great unit.

Capacities from 600,000 to 2,500,000 BTU/hr. input.



AVERAGE 10% LESS IN OPERATING COST

Lo-BLAST Power Gas Burners save money because they eliminate the fuel waste caused by uncontrolled draft.

When a *power type* burner shuts off, there is no rush of draft air to carry heat up the chimney, a condition which would cause a serious fuel waste. The Lo-BLAST Burner does not depend upon natural draft, but upon air supplied by a small *quiet* blower. It provides combustion air *only when the burner is on!* When the burner shuts off, the flow of air shuts off. The heating plant thus retains much of its heat between operations.

That's why Lo-BLAST Burners cost substantially less to operate.

SEND TODAY FOR COMPLETE INFORMATION

MID-CONTINENT METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

WE HEAR THAT...

▸ *BARBER-COLMAN CO.* will expand plant facilities in Rockford, Ill., by approximately 170,000 sq ft for the production of automatic controls, air distribution products, industrial instruments, and other items.

▸ Harold P. Mueller, Sr., has relinquished the offices of president and general manager of the *MUELLER CLIMATROL DIV., WORTHINGTON CORP.*, to his son, Harold P. Mueller, Jr. The new president is the fourth generation to head the firm. The senior Mueller will continue as a director.

▸ *PETER CARVER ASSOCIATES, Consulting Engineers,* have announced the removal of their offices to 235 W. 46th St., New York 36, N.Y.

▸ *UNION CARBIDE CHEMCIALS CO.* is now operating its new Technical Services Laboratory in Tarrytown, N.Y. Purpose of the facility is to aid in development and improvement of the products of the company's customers.

▸ *ULTRASONIC INDUSTRIES, INC.*, has completed arrangements with *INDUSTRIKEME* A/S, Denmark metal finishing equipment manufacturer, for the mutual distribution of each company's products in their respective countries.

▸ *THE SKUTTLE MFG. CO.* is celebrating its 25th anniversary as manufacturers in the field of humidifiers and air filters.

▸ *LAU BLOWER CO.* has purchased *VIKING AIR PRODUCTS DIV., CRANE CO.*

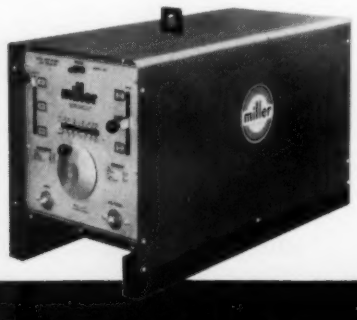
▸ *HAVEG INDUSTRIES, INC.*, has entered into an agreement to purchase the equipment and inventory of the *BLOW-O-MATIC CORP.*, Bridgeport, Conn., blow molding plastics organization.

▸ *TITUS MFG. CORP.* has opened a new branch manufacturing plant in Terrell, Texas, for the manufacture of extruded aluminum grilles and diffusers for the Texas and Southwest markets.

▸ *BARRY CONTROLS, INC.*, and *THE WRIGHT LINE, INC.*, directors have voted to recommend merger of the two firms to stockholders. The latter company manufactures accessory and punched card handling equipment for data processing computer systems.

miller WELDERS

BIG TWIN 250 AC/DC



LITTLE TWIN 180 AC/DC

AND BOTH MILLERS ... Through and Through

BIG TWIN combination ac-dc welders work from single phase service — deliver new convenience and economy. Two a-c amperage ranges of 20-125 and 60-290 plus two d-c ranges of 18-100 and 65-290 amps master nearly every welding requirement from light gauge metal to structural pieces. Movable shunt type transformer affords infinite current adjustments. Other features include: Horizontal design for easy stacking; weather-resistant construction and Class B insulation; Miller-built semi-metallic rectifier for best d-c welding; high open circuit voltages and new weld stabilizer. This is THE all-time, all-around welder!

LITTLE TWIN ac-dc combination welder has two a-c amperage ranges of 20-115 and 60-180 plus one d-c range of 40-150. Operating from single phase service, this Miller model incorporates many design and construction features usually found only in large industrial types. These include really rugged construction, forced air cooling, new Miller semi-metallic rectifier, movable shunt type current control, new weld stabilizer and open circuit voltage in abundance. Power factor correction is available on both models. Complete specifications on either model will be sent promptly upon request.

miller ELECTRIC MANUFACTURING COMPANY, INC., APPLETON, WISCONSIN

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

WE HEAR THAT

Continued

▸ *JAMES W. GALBREATH*, senior mechanical engineering student at Purdue University, has been awarded the W. T. Miller prize for the current school year by the Indiana Chapter of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers. The award is based upon "activity points" of the student branch members and was created to promote a greater interest among students in the field.

▸ The stock of *PALL CORP.*, has been admitted to trading on the American Stock Exchange.

▸ *ARMSTRONG CORK CO.* has renewed undergraduate scholarship awards at eight universities and established two new scholarships at Colgate University and Grove City College. Renewals are at Cornell, Dartmouth, University of Delaware, University of Illinois, Lafayette College, University of North Carolina, Ohio State University, and Rutgers. Graduate science fellowships at the University of Pennsylvania, Pennsylvania State University, Princeton, and Lehigh were also renewed.

▸ *F. W. DWYER MFG. CO.* has begun construction of its new headquarters and plant in Michigan City, Ind. Scheduled completion date is August 1, 1960.

▸ *H. K. PORTER CO., INC.*, has purchased the assets of *ALLIED PAINT MFG. CO.*, of Tulsa, Okla.

▸ *THE FLINTOKE CO.* has announced acquisition of all outstanding stock of *THE SEALZIT CO.*, Riverside, Calif.

▸ *AMERICAN NICKELOID CO.* has announced removal of its New York office to 1001 Franklin Ave., Garden City, L. I., N. Y.

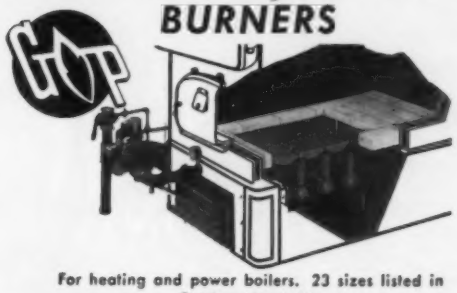
▸ *TURNER CORP.*, Sycamore, Ill., is celebrating its 90th anniversary.

▸ *HOOKER CHEMICAL CORP.* directors have approved plans for a new northern Kentucky plant for the production of synthetic phenol. Completion is scheduled for late 1961.

▸ *H. C. LITTLE BURNER CO., INC.*, has purchased *TAMCO CORP.*, Sebastopol, Calif., manufacturer of air conditioning equipment and gas fired furnaces.

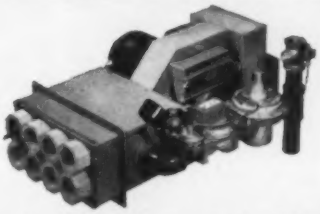
"Planned Performance"*

BURNERS



For heating and power boilers. 23 sizes listed in Catalog No. A-10.

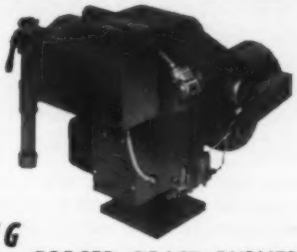
BLUE LINE UPSHOT ATMOSPHERIC GAS BURNER



Fully automatic, packaged assembly. Sizes listed to 28 million BTU/HR in Catalog C-10

TURBO-FIRE POWER TYPE GAS BURNER

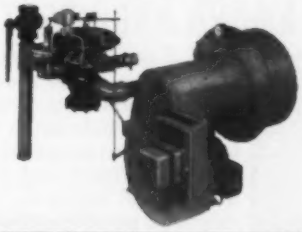
MODEL R
Capacities up to 2¼ million BTU/HR
Catalog E-61



TURBO-RING FORCED DRAFT BURNERS

Gas, oil, or combination Gas-Oil burner. No stack required on boilers equipped for pressure firing.

MODEL FGR
Capacities 1 to 9 million BTU/HR
Catalog E-51



* PLANNED — Factory assembled, pre-wired for "Bolt-in" installation.

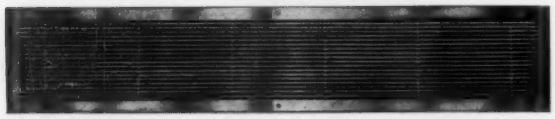
* PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Gordon & Piatt also manufacturer of a complete line of domestic conversion burners plus large dual-fuel units. Write for literature and complete information.

Gordon & Piatt
P. O. Box 914
Winfield, Kansas

In America's Finest Buildings...

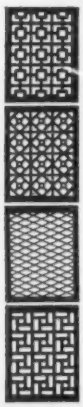
LOOK BETTER... LAST LONGER!



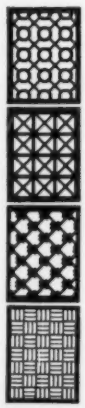
DIAMOND FABRICATED GRILLES

. . . meet the current demand for a very strong bar-type grille which provides more than the usual percentage of open area and is suitable, in general appearance, for use with practically any modern style of interior design. Specified by leading engineers and architects for Schools, Colleges, Hospitals, Ocean Liners, Sports Arenas, etc. Custom Built (no standard sizes) in any specified rectangular size or shape — All Steel or All Aluminum — for either direct or deflected air flow. Write for Bulletin 43.

DIAMOND ARCHITECTURAL GRILLES



. . . are stamped from Steel, Aluminum, Bronze or any other commercial metal; in a wide variety of artistic designs, in any desired thickness up to one-quarter inch, with correspondingly LARGE unit openings. Widely used, for nearly half a century, in America's finest buildings, they have proved practically indestructible — standing up for years against any probable amount of rough usage. Bulletin 41 illustrates and describes a number of popular designs and applications. Catalog 36 (100 pages) contains actual-size illustrations of ALL Diamond Grille designs, together with complete working data. Write for either or both — no charge or obligation.



DIAMOND MANUFACTURING CO.
Box 41 WYOMING (Wilkes-Barre Area) PENNA.

WHO'S WHAT . . .

(New personnel, promotions)

▸ *COOPER ALLOY CORP.* — Gerald Lewis, director of product development.

▸ *RESEARCH-COTTRELL, INC.* — James P. Kneubuhl, president; L. Grant Bragg, manager, Canadian subsidiary.

▸ *THE FAFNIR BEARING CO.* — Stanley G. Fisher, general sales manager.

▸ *PORTER-CABLE MACHINE CO.* — Frank Burgmeier, public relations director.

▸ *THE NU-WAY CORP.* and *SUNDSTRAND ENGINEERING CO.* — William R. Sinks, sales manager.

▸ *FEDERATION INTERNATIONALE des INGENIEURS-CONSEILS* — Edward J. Wolff, Edward J. Wolff and Associates, Consulting Engineers, Chicago, member of the executive committee of the international organization of consulting engineer associations.

▸ *THE MATHES CO.* — Robert B. Starnes, president; Claude Birdsell, sales manager; Sam Chambers, assistant to the sales manager; Benjamin R. Ebersman, past president, has returned to duties as vice president of the parent company, *GLEN ALDEN CORP.*

▸ *WEBSTER ENGINEERING DIV., MIDLAND-ROSS CORP.* — W. E. Robb, project engineer.

▸ *THE HEATING AND AIR CONDITIONING RESEARCH AND DEVELOPMENT ASSOC.* — Frank T. Daddario, Durham, N.C., president; new vice presidents: David W. Moser, Asheville, N.C.; M. A. Weaver, Collinsville, Va.; W. O. Blackstone, Columbia, S.C.; and Sam R. McCoy, Orlando, Fla.

▸ *STRUTHERS WELLS CORP.*—James F. Sweeney, executive vice president; I. S. Brumagim, vice president of sales; Paul Ristau, vice president of manufacturing.

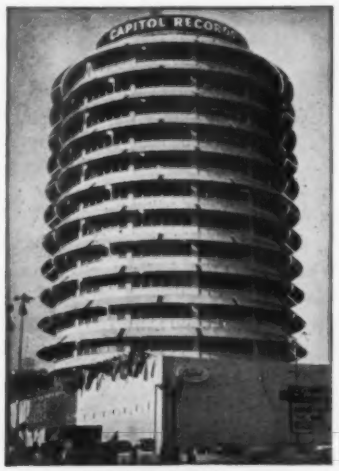
▸ *COPPER & BRASS RESEARCH ASSOCIATION* — president: G. P. Bakken, president of Chase Brass & Copper Co.; senior vice president: E. P. Dunlaevy, executive vice president of Phelps Dodge Copper Products Corp.

WEBCO-RAY
HUSKY
Packaged Boilers

For the first time... Full Modulation at low cost

New HUSKY Series packaged boilers are designed to deliver maximum efficiency and economy in the 20 to 125 boiler horsepower range. Models to burn light oil, natural gas, or combination gas-oil. Exclusive full modulation for either oil or gas provides steady performance at any load requirement. HUSKY is completely factory packaged making field installation fast and simple. Webco-Ray factory trained local representatives provide immediate service and local parts supply. Write for new HUSKY catalog and the name of your local Webco-Ray representative.

WESTERN BOILER COMPANY
47 Rousseau Street, San Francisco 12, California
4024 Filbert Street, Philadelphia 4, Pennsylvania



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE

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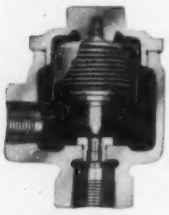
Pittsburgh 30, Pa. Plant—1620 Pennsylvania Ave.

RIGGIO

THERMOSTATIC STEAM TRAPS

FOR MAXIMUM EFFICIENCY CHOOSE FROM THIS LINE OF RIGGIO THERMOSTATIC STEAM TRAPS

For pressures from Vacuum to 200 lbs. Bronze Construction ½", ¾", 1"



TYPE A-200 Freeze-Proof

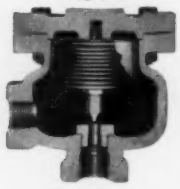
Simple

Rugged

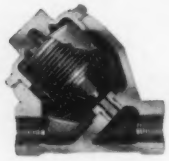
Versatile

Tight Shut-off

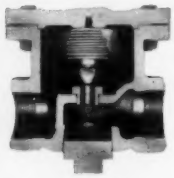
For pressures from Vacuum to 250 lbs. Semi-steel Construction ½", ¾", 1", 1¼", 1½", 2"



TYPE C-250 Freeze-Proof



TYPE Y-200



TYPE B-250

For additional information contact

FRANK D. RIGGIO CO., INC.
State Highway 17, Rutherford, New Jersey
Phone Webster 9-8450

Stainless pipe and fittings

IN STOCK

Your complete stainless piping package is available for immediate shipment in a variety of sizes and analyses.

PIPE: ⅛ IPS through 12" IPS seamless and welded schedules 5 - 80

FITTINGS: ⅛ IPS through 4" IPS threaded and welding type

VALVES: ¼ IPS — 2" IPS

Also **mill shipments** of corrosion resistant items up to 48" OD. Send for FREE literature.

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6 Warehouses serving the middlewest

CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • TULSA • KANSAS CITY

WHO'S WHAT

Continued

▸ *FLEXIBLE TUBING CORP.* — William Gibb, Jr., secretary and controller.

▸ *INTER-SOCIETY CORROSION COMMITTEE* — R. R. Pierce, Pennsalt Chemicals Corp., chairman; T. J. Maitland, American Telephone and Telegraph Co., vice-chairman.

▸ *CRUCIBLE STEEL CO. OF AMERICA* — Walter E. Gregg, vice president, technology.

▸ *BUFFALO FORGE CO.* Charles W. Lockhart, vice president, sales.

▸ *WESTINGHOUSE ELECTRIC CORP.* — H. W. Rainey, Jr., marketing manager, Sturtevant Division; Carl E. Cannon, product sales manager for electric heating, and S. R. Hill, senior staff engineer, respectively, for Staunton, Va., air conditioning division.

▸ *METAL VENTILATOR INSTITUTE* — J. F. Thorne, vice president and chairman of the Technical Committee.

▸ *GENERAL DEVICES, INC.* — John W. Thompson, industrial relations manager.

▸ *TENNEY ENGINEERING, INC.* — Jerome Perlstein, staff member, development engineering group.

▸ *COOLERATOR DIV., McGRAW-EDISON CO.* — Charles J. Kayko, vice president of engineering and manufacturing; Wendell Webster, chief engineer, air conditioning products; Robert F. Knudson, chief engineer, heating products. *ALBION DIV.* — Donald G. Hilligoss, sales manager, HeaTube department.

▸ *POLARAD ELECTRONICS CORP.* — A. H. Sonnenschein, director of planning.

▸ *AMERICAN-STANDARD AIR CONDITIONING DIV.* — John M. Englisby, manager, electric heating.

▸ *WALWORTH CO.* — Marvin H. Grove, chairman of the executive committee and chief executive officer.

▸ *THE NATIONAL SUPPLY CO.* — Sidney A. Shuman, assistant to the president.

WHO'S WHAT

Continued

▸ *THE BRISTOL CO.* — R. Melvin Gabey, export manager.

▸ *ALLIS-CHALMERS MFG. CO.* — Leonard H. Sence and Bruce R. Lipe, chief engineer and assistant chief engineer, respectively, centrifugal pump department; Joseph M. Duncan, assistant general manager, Washington, D.C. office.

▸ *AIR-CONDITIONING AND REFRIGERATION INSTITUTE* — H. T. Jarvis, president, Recold Corp., chairman of the 12th Exposition Committee.

▸ *HEIL PROCESS EQUIPMENT CORP.* — R. F. Protiva, manager, Cleveland plant.

▸ *ACME INDUSTRIES, INC.* — Maurice A. Furvinal, chief project engineer.

▸ *ARVIN INDUSTRIES, INC.* — Eldo H. Stonecipher, president and general manager; Joseph C. Freeland, sales manager, electric heat division.

▸ *CONOFLOW CORP.* — Nicholas R. Delaney, treasurer; Fred H. Sandritter, assistant advertising manager.

▸ *MARKET ELECTRIC PRODUCTS, INC.* — Robert H. Jacobson, assistant sales manager, portable products.

▸ *STEWART-WARNER CORP.* — William E. Judd, vice president.

▸ *FRICK CO.* — Matthew M. Gouger, executive vice president and member, board of directors.

▸ *YORK DIV., BORG-WARNER CORP.* — new president: Joseph B. Elliott, formerly president of Schick, Inc., and Tele-Dynamics, Inc.

▸ *BATTELLE MEMORIAL INSTITUTE* — Dr. Horace J. Grover, staff physicist, department of mechanical engineering.

▸ *THE INTERNATIONAL NICKEL CO., INC.*— Henry S. Wingate, chairman of the board and chief officer; J. Roy Gordon, president; Ralph D. Parker, senior vice president; Dr. John F. Thompson, honorary chairman and chairman of executive committee.

Eliminate PIPELINE CORROSION, ABRASION, NOISE, VIBRATION, EXPANSION

CONDOR FLEXIBLE RUBBER PIPE

- Flexible, Strong, Light Weight
- For Working Pressures up to 250 psi
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- Easy to install
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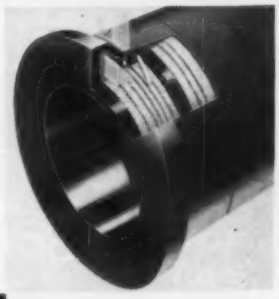

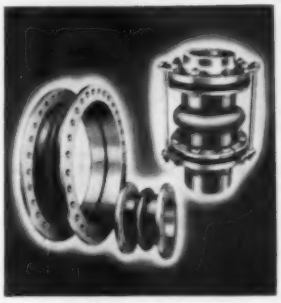

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- Overcome Expansion Stress
- Avoid Misalignment
- Maximum Resistance to Shock
- Require No Gaskets

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RM1038

Engineered Rubber Products . . More Use per Dollar

RAYBESTOS-MANHATTAN, INC.

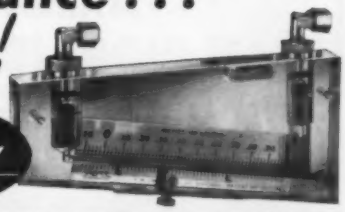
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

RM

FILTER EFFICIENCY

at a glance . . . anytime!

Dwyer



AIR FILTER GAGE

With the Dwyer Air Filter Gage you can be sure of maximum filter efficiency because you know the *exact* time to replace filters, *every time*. Gives a continuous, accurate check that spots inefficient filters, yet prevents waste through premature replacement.

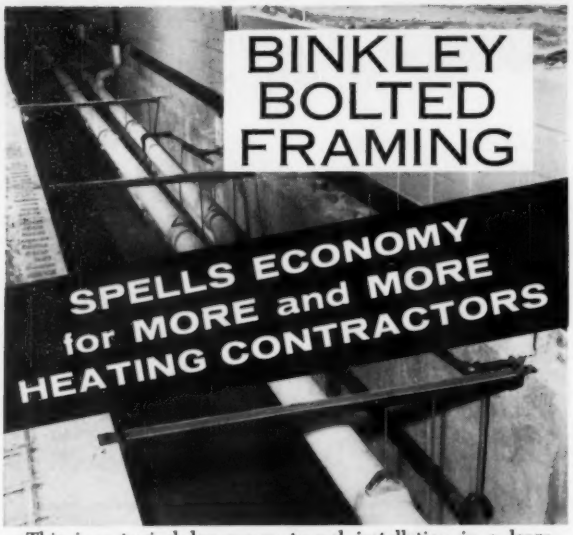
The Dwyer measures filter efficiency the only practical and economical way—via pressure drop. Quickly pays for itself through savings in replacement and service time and greater operating efficiency.

Break-proof plastic construction, lifelong accuracy, simple installation, no moving parts to ever wear out or get out of adjustment. Ranges 0-½", 0-1", 0-2" and 0-3" water. A complete unit with all necessary tubing, fittings, etc.

Write for Bulletin C10

F. W. DWYER MFG. CO.

P. O. BOX 373-H • MICHIGAN CITY, INDIANA



This is a typical lay across tunnel installation in a large midwestern high school. Binkley channel, spring nuts, threaded rods and pipe clamps are quickly and easily assembled, eliminating old fashioned methods which require costly drilling, welding, and other labor.

Binkley Bolted Framing compares favorably with other strut-type material for both price and quality. Standard parts available from stock . . . call or write for catalog and price list today!

Choice distributor territories still open!

BINKLEY BOLTED FRAMING SALES CO.
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Plant and Warehouse at Warrenton, Missouri

NEW! The high quality of

STAINLESS STEEL
. . . at lower cost!

TRERICE BX SERIES ***INDUSTRIAL***
THERMOMETERS

Now available! The new high-quality, low-cost Trerice BX Series Thermometer with stainless steel front and bulb chamber. Easy-to-read scale markings . . . large red appearing mercury tube . . . durable 9-inch cast aluminum case. Guaranteed accurate temperature indication! Available in standard range models from —40°F to 950°F. No extra cost for straight, right side, left side, regular angle, regular oblique, or reverse oblique forms.

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Please send bulletin 201 describing Trerice BX Industrial Thermometers!

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ADDRESS_____
CITY_____ ZONE____ STATE_____

TRERICE TEMPERATURE AND PRESSURE INSTRUMENTS

WHO'S WHAT

Continued

▸ *HAUCK MFG. CO.* — Walter W. Weeks, secretary; Arthur V. Lazenby, assistant sales manager, equipment division.

▸ *OIL HEAT INSTITUTE OF AMERICA, INC.* — Charles H. Burkhardt, managing director.

▸ *CHRYSLER CORP., AIRTEMP DIV.* — Marshall J. Bean, manager of export administration; Richard J. Leaman, manager of sales administration.

▸ *THE TRANE CO.* — Frank A. Votava, manager, market research department.

▸ *IDEAL CORP.* — new vice presidents: John Wenzel, Leo Strauss, and Bart Kelleher.

▸ *THE LELAND OHIO ELECTRIC CO.* — G. William Schreck, sales manager.

▸ *UNITED ENGINEERS TRUSTEES, INC.* — Antoine Marc Gaudin, Massachusetts Institute of Technology, chairman of the Engineering Foundation.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.* — R. S. Fries, manager of commercial operations.

▸ *ARMSTRONG CORK CO.* — Wayne Keller, vice president.

▸ *CRS INDUSTRIES, INC.* — Michael H. Pelosi, Jr., director of engineering.

▸ *BONNEY FORGE AND TOOL WORKS* — new vice presidents: George D. Fritch, William M. Jackson, Richard R. Holstom, and George A. Hart.

▸ *COLVIN LABORATORIES, INC.* — Earl E. Hall, sales manager.

▸ *HAGAN CHEMICALS & CONTROLS, INC.* — new directors: C. L. Barksdale, vice president, Jobber Sales Div.; and T. W. Bruner, president, Bruner Corp.

▸ *BURNHAM CORP.* — Dick Riordan, chief engineer, summer air conditioning.

MEETINGS & CONVENTIONS

SEPT. 7-9—*Joint Automatic Control Conference*, Massachusetts Institute of Technology, Cambridge, Mass.

SEPT. 14-17—*Second Annual Southeastern Maintenance and Engineering Show.* Sponsored by North Carolina chapters, American Institute of Plant Engineers, American Welding Society, and Maintenance Council of North Carolina Motor Carriers Assoc. State Fair Arena, Raleigh, N.C. Information: John Harden Associates, P.O. Box 3173, Greensboro, N.C.

SEPT. 26-29—*American Welding Society Fall Meeting.* Penn-Sheraton Hotel, Pittsburgh, Pa. Information: American Welding Society, 33 West 39th St., New York 18, N.Y.

SEPT. 26-30—*Instrument Society of America, Fall Instrument-Automation Conference and Exhibit, and* 15th *Annual Meeting.* New York Coliseum. Information: W. F. Minnick, Jr., Director of Public Relations, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

OCT. 12-15—*Cast Bronze Bearing Institute and Non-Ferrous Founders' Society annual meetings.* Grove Park Inn, Asheville, N.C. Information: Non-Ferrous Founders' Society, 1604 Chicago Ave., Evanston, Ill.

OCT. 17-21—*48th Annual National Safety Congress.* Industrial safety sessions, Conrad Hilton, Pick-Congress, Sheraton Towers, Morrison, and La Salle hotels, Chicago. Information: R. L. Forney, secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

NOV. 28-*DEC.* 2—*24th National Exposition of Power and Mechanical Engineering.* Under auspices of the American Society of Mechanical Engineers. New York Coliseum. Information: International Exposition Co., Inc., 480 Lexington Ave., New York 17, N.Y.

DEC. 12-15 — *Industrial Building Exposition and Congress.* New York Coliseum. Information: Clapp & Poliak, Inc., Management, 341 Madison Ave., New York 17, N.Y.

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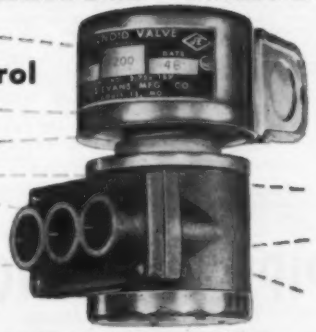

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MEETINGS & CONVENTIONS

Continued

1961

JAN. 30-*FEB.* 2 — *National Plant Maintenance & Engineering Show.* International Amphitheater, Chicago. Information: Clapp & Poliak, Inc., Management, 341 Madison Ave., New York 17, N.Y.

FEB. 13-16. — *American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., semi-annual meeting.* Conrad Hilton Hotel, Chicago, Ill. Information: ASHRAE, 234 Fifth Ave., New York 1, N.Y.

FEB. 13-16 — *International Heating and Air Conditioning Exposition.* International Amphitheater, Chicago, Ill. Information: E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N.Y.

MARCH 27-31 — *Third National Symposium on Temperature-Its Measurement and Control in Science and Industry.* Sponsored by American Institute of Physics, Instrument Society of America, and National Bureau of Standards. Columbus, Ohio. Information: W. R. Tilley, National Bureau of Standards, Washington, D.C.

NEW BOOKS & REPORTS...

American Society for Testing Materials Proceedings, 1959. 1424 pp. Includes 71 reports of technical committees, 44 technical papers, summary of annual meeting. ASTM, 1916 Race St., Philadelphia 3, Pa. $12.00

Proceedings of Technical Meetings, U.S. Atomic Energy Commission—29 pp. Lists and describes published proceedings of 126 selected meetings, conferences, and symposia held in past 10 years. AEC Technical Information Service Extension, P.O. Box E, Oak Ridge, Tenn.

1959 *Supplement to American Welding Society Bibliographies.* American Welding Society, Department T., 33 W. 39th St., New York 18, N.Y. $1.50

Standards Publication for Adsorption Equipment—1960 edition. Covers definitions, determination of moisture vapor dew point in pressure ranges of 0 to 10 psi and 10 to 500 psi, and procedures for testing solid adsorption type dehumidifiers. National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N.Y. 40 cents.

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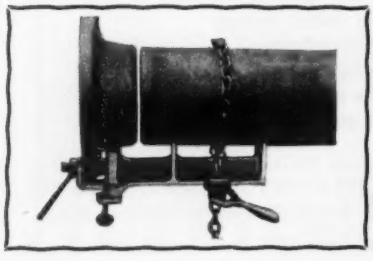

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Manufacturer of four complete lines of commercial and industrial forced air heating equipment, ranging from 185,000 to 2,000,000 B.T.U. output, has openings in many sections of the country for active representatives with allied lines. See our advertisement on page 183. Mammoth Furnace Company, 6425 Cambridge St., Minneapolis 16, Minnesota.

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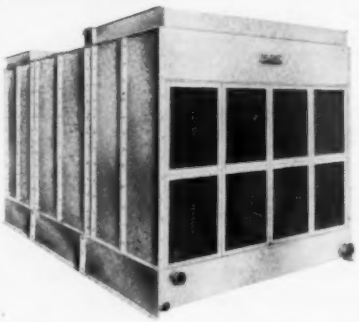

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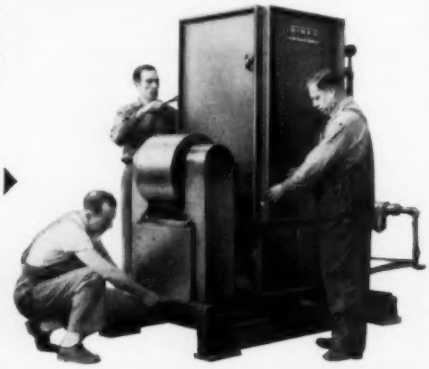

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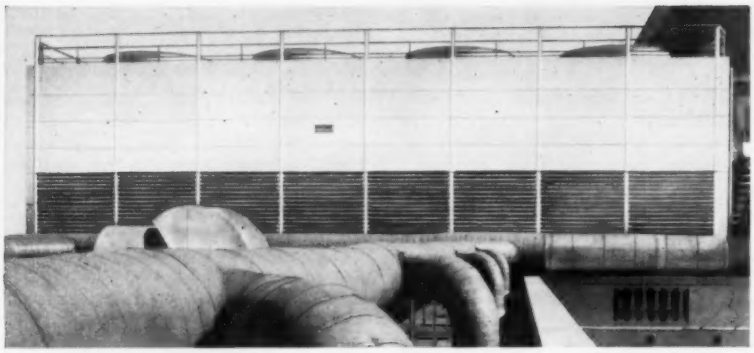

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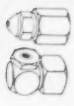

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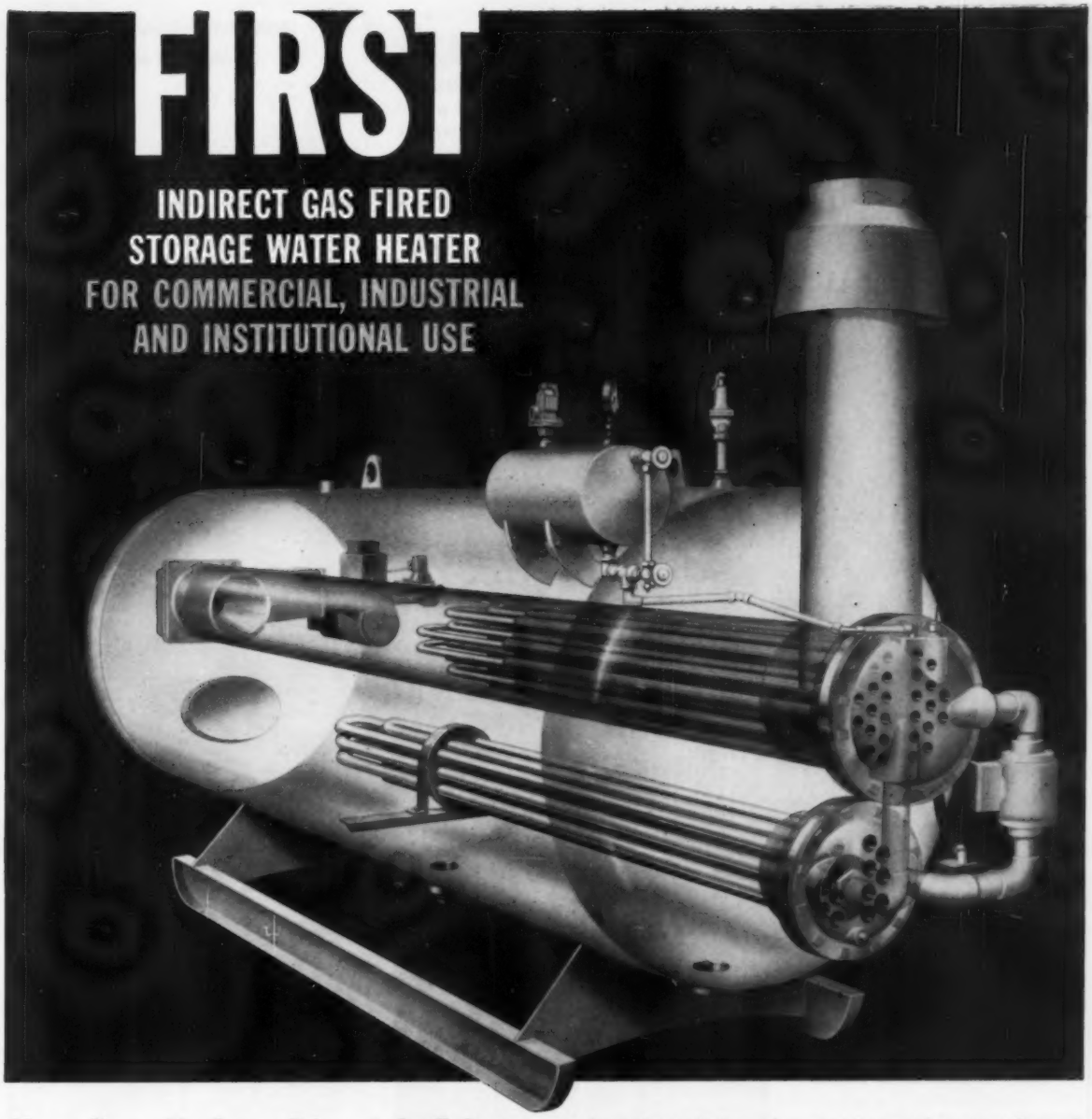

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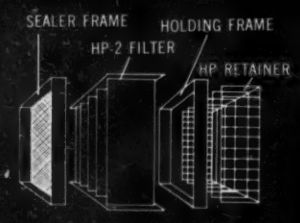

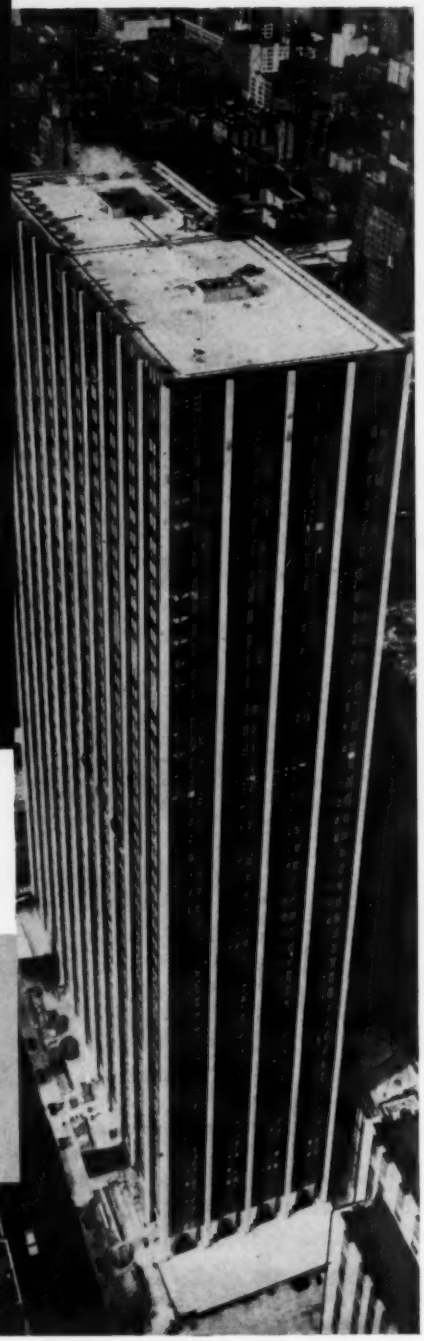

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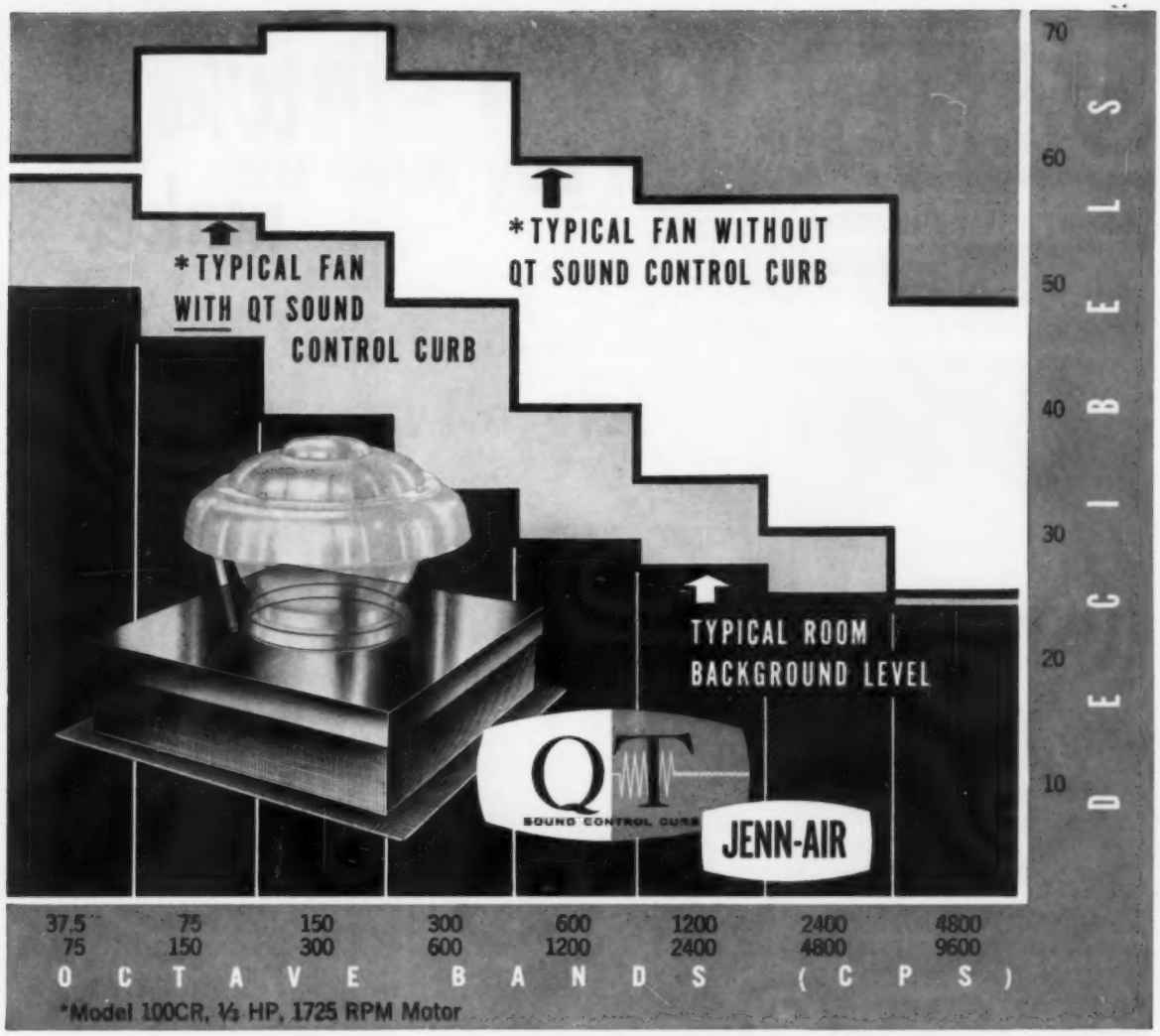

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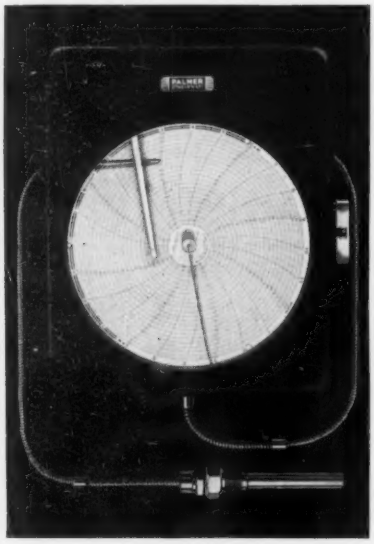

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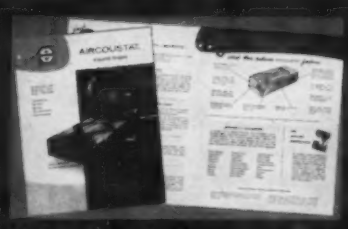

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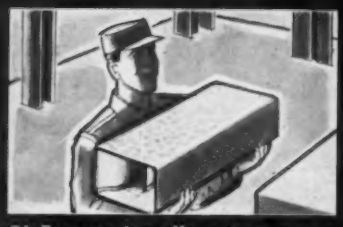

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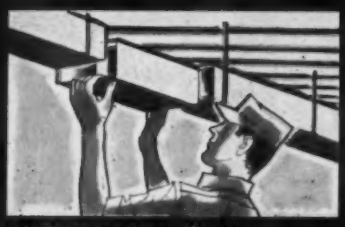

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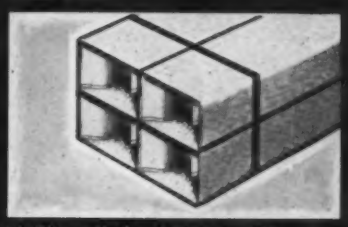

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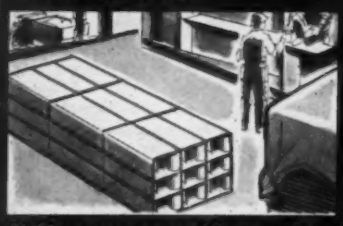

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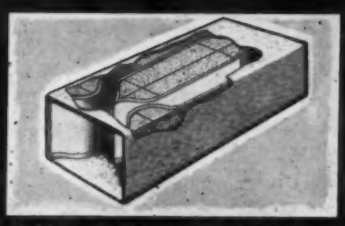

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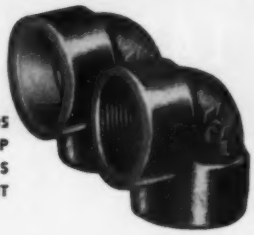

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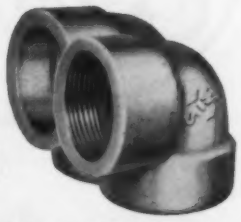

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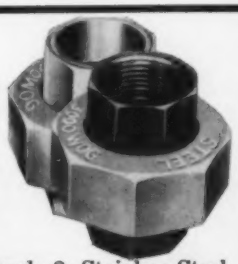

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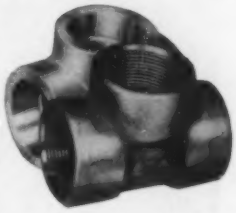

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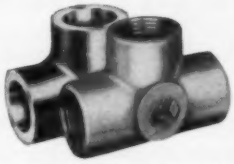

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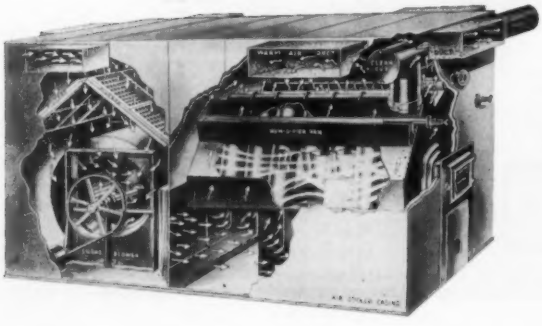

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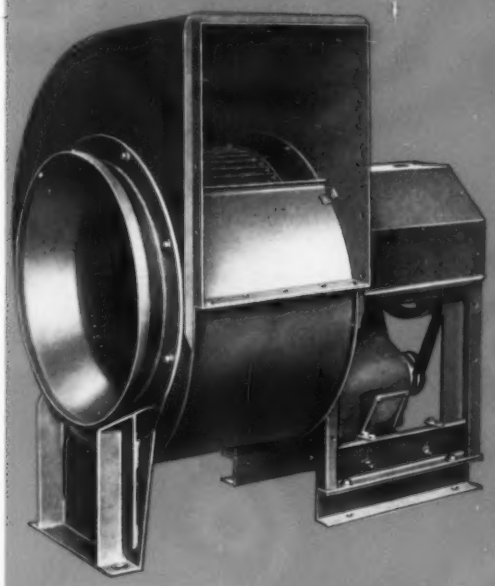

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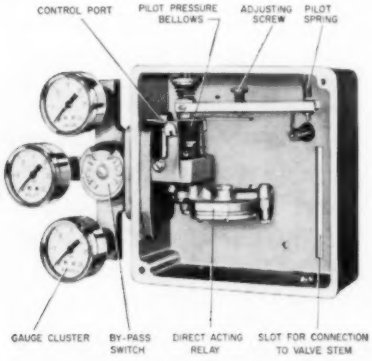

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